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ABSTRACT

Presented are several elementary school lessons dealing with marine shell-bearing animals. Among the aspects of mollusk biology investigated are anatomy, diversity of form, adaptations, and classification. Learning strategies used include field trips, creative writing exercises, art activities, poetry, and scientific observation. A set of 40 student worksheets is provided, along with tips for organizing a field trip and a list of resource materials. (WB)

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ALASKA SEA WEEK CURRICULUM SERIES
SECOND GRADE

Shells

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SE 035 508

UNIVERSITY OF ALASKA

DRAFT

SHELLS

A Study Guide for the Second Grade

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ALASKA SEA WEEK CURRICULUM SERIES

Field-test edition March 1980
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ACKNOWLEDGEMENTS

Sea Week began in the early 1970's in Juneau, Alaska. Under the leadership of Mary Lou King, parents, teachers and agency personnel started taking elementary school students down to the sea every spring. Soon, Sea Week was an annual event with some of the junior high and high school students assisting the younger pupils on their field trips to beaches, wetlands, forests and glaciers. In 1978, a K-6 Sea Week curriculum was written with the assistance of Juneau teachers, scientists, fishermen, parents, and government employees - a true community effort. In 1979, the Southeast Regional Resource Center revised the material, adding worksheets and graphics and reworking certain activities. In 1980, endorsed as "The Year of the Coast" by President Carter, it seems very fitting that the Alaska Sea Grant Program is initiating a program to spread Sea Week statewide.

This first statewide edition is a product of Juneau - its people and environment. We would like to express our deep appreciation to the many foresighted people who contributed to Sea Week and especially to all the students who are the reason and impetus behind its success. Special thanks to Mary Lou King, Nancy Barr, Janie Cesar, Carol Koski, Dick and Betty Marriot, Virginia Eggert, Claudia Kelsey, Kathy Hanna, James G. King, Lynn Szepanski, Karen Gunstrom, Mary Beth Parsons, Dan Hopson, Kristi Kantola, Pat Thrasher, Tamara Smid, Judy Maier, Jerry Hard, Marty Early, Jan Conner, Mark Hansen, the Alaska Department of Fish and Game, the Alaska Coastal Management Program, the United States Forest Service, the Alaska Department of Environmental Conservation, the United States Fish and Wildlife Service, and the South East Regional Resource Center.

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PREFACE

The Alaska Sea Week Curriculum Series (K-6) emphasizes one or more aspects of the marine environment at each grade level. Kindergarten materials, for instance, are intended to introduce students to the exciting and curious world of the sea and shore. At the other end of the series, materials for sixth graders stress man's interactions with the marine environment. While the subject matter at each grade level is unique, as a whole the grade level guides will yield a broad understanding of the marine environment and its importance to Alaskans.

The purpose of this curriculum series is to help the teacher in interpreting the marine environment for elementary school students. However, what is included here is just a place to begin. As you read the following materials, you will find factual information about many aspects of the marine environment, and suggestions for presenting these concepts to students through multi-disciplinary activities both in the classroom and at field sites. Materials are organized into units, each covering a single idea or subject. From these you, the teacher, may select the units and activities which are best suited to your class, community and resources.

"Sea Week" originated in Juneau, and these curriculum materials are most applicable to southeast and southcentral Alaska. However, the Alaska Sea Grant Program has funded a three year pilot project to expand Juneau's successful program statewide. As Sea Week is piloted in 14 communities around the state, the Curriculum Series will be expanded to meet the needs of western, interior, and northern Alaska.

Send us your comments and suggestions. The strength of the final edition will depend not only on those of us staffing the project - but on you - your ideas and comments. After you've tried some of these activities fill out and send in the evaluation sheet at the back of this book. Thanks so much!

Jill Thayer/Belle Mickelson, Coordinators
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479-7631/7086

INTRODUCTION

Alaska has more than 33,000 miles of shoreline; the earth's circumference is only about 25,000 miles. Much of Alaska's complex and intricate shoreline is accounted for by the bays, inlets, headlands, islands of Southeast Alaska. Here, in Alaskan communities large and small we live in close contact with the marine world. Some of us make our livings by fishing or working for the Coast Guard, the State's marine transportation system, or marine shipping companies. Most of us spend at least some of our time sport fishing, digging clams, beachcombing, or just gazing out at the incredible scenery of snowcapped mountains and everchanging inland waters.

The dynamic marine environment of which we are a part is our heritage, our trust. It is only fitting that our children know that world intimately so that they can grow up in an understanding of its complexities, it subleties, its importance. This is of particular urgency now that Alaska is facing increasing pressures to make decisions that will effect the use of her lands and seas for generations to come. We, and our children, must have a part in the decision making processes and the more knowledgeable we are, the more effective our participation will be.

Teaching children about the world in which they live is important and perhaps it has never been more important than it is in Alaska today. Teaching facts and concepts about the marine world is important but perhaps most important of all is the teaching of attitudes. It is hoped that through the study of marine life, students may gain the following:

1. An increased interest in their environment.

2. A greater awareness, appreciation, respect for the natural world that is so close about them here in Alaska.

3. The sheer delight, pleasure, happiness that can come from observing and understanding nature close up.

4. A sensitivity to the relationship between themselves and their environment.

If that can be accomplished, all our lives will be better because of it....

INTRODUCTION - SECOND GRADE

If the Sea Week Curriculum Series is in use in your school, students entering second grade will already have been introduced to the sea and its inhabitants. Through discovery techniques and instruction they have learned about the myriad life forms that populate Alaska's marine shores.

At a second grade level focus is directed more specifically to one group of marine animals, the mollusks or shell-bearers. By learning about mollusks in some detail, students will begin to appreciate the great complexity and diversity that can and does exist in every kind of living thing.

Specifically, the following are some aspects of marine shell-bearers that students may explore:

1. The scientific grouping of animals according to their structural similarities.

2. The internal anatomy of the soft, shell-bearing animal.

3. The diversity of form among mollusks and how diversity is related to environment and way of life.

4. The shell-bearers means of reproducing.

A multi-disciplinary approach has been used with these materials. Mathematics, scientific discovery, reading, creative writing, listening, verbal expression, and art are all an integral part in the students learning about one specific aspect of the marine environmant.

Through classroom and field trip experiences, students should gain a deepening appreciation of a natural environment and increased confidence in their own ability to understand the world around them.

S H E L L S

Introduction

In this marine curriculum series, the focus of second grade is Alaska's marine shells. If students have been in the school district during kindergarten and first grade, they have learned a general appreciation for the sea as a complex environment and they are familiar with the wide range of plants and animals to be found intertidally on Alaska's shores. Focusing more narrowly, second graders will look at one particular group of marine animals - the shelled mollusks.

Vocabulary and Classification

As students examine shell differences and shell structures, they will quickly realize the need for vocabulary words that can be used to label unfamiliar shapes or parts and vocabulary should be an important part of the second grade study. Some names for parts of shells are essential; learning the scientific names of a number of locally occurring animals should be left to the discretion of the teacher - with the reminder that sometimes children take a real feeling of pride from learning a big word or two that sufficiently challenges their minds and tongues!

Since relatively few sea shore creatures have generally accepted common names, (and many none at all), it is almost essential to use the scientific names. Scientific names consist of two parts: genus and species. The first, the genus, stands for a group of closely related animals or plants. The second, the species, is usually descriptive, though it may be named for a person. Sometimes there will be a third, for a subspecies or variety; but none of these are used in this booklet.

The children may understand the idea of the genus being like the family name of Smith, and the species being Elizabeth Smith, Robert Smith and James Smith, (except that the family name Smith is said first, as Smith, Elizabeth). For the many "common names" or "nicknames", Elizabeth may be called "Betty", "Beth", "Liz" or "Betsy." Robert may be called "Bob", "Bobbie" or "Rob." James may be called "Jim", "Jimmie" or "Jamie." They are all Smiths and probably look something alike, but each one is different and has his own name.

(One catch is to make them understand that all the ones that are alike have the same name - all of one species - and that not every individual clam has its own name!)

R. Tucker Abbott says that "Despite two centuries of research, there are great gaps in the biological knowledge of mollusks..." So changes in classification are still being

made (as well as differences of opinion!). You will note name changes have been made, and more will be made. The older texts will have more "outdated" names. However, it is still possible to track down your exact species. With the children the broader classifications are enough. Many of your children already know these, and some may enjoy learning the full scientific names. Perhaps there may be interested parents or a teacher's aide who would work with "advanced" pupils on arranging a display for your school or class using the scientific names (and/or the common names). If a child uses a book to "identify" a specimen, (unless it is glaringly wrong), accept it or encourage him to look a little further.

Presentation of Materials

Keys to understanding shelled animals as complicated and interesting creatures are the series of worksheets that are included here. Hopefully you will be able to use posters and other illustrations, plus real shells along with the printed student materials.

All the illustrations both in the student pages and in the teacher information are life-sized unless otherwise noted - i.e. the gum boot - but they may have been drawn from either large or small specimens. Therefore the size of the shells which you actually find on the shore may vary considerably from that of the illustrations.

For the most part, the shells illustrated are those most often seen in our area, and those which seem fairly distinctive. Most second graders should be able to recognize them.

Worksheets may be used as a cumulative record of each students study. Along with other art, language and math pages related to mollusks, they could form a booklet that summarizes the unit work for each student.

In addition to worksheets containing information about the shells themselves, many ideas for related activities involving arts and crafts, scientific observation, language and math skills are included. For the most part these are found at the end of the unit, but they should be used by the teacher in any way and at any time that best fit the needs of the class.

Unit 1. AN INTRODUCTION TO MOLLUSKS

Objectives

-To understand that Mollusks include a number of animals that appear to be quite different from each other.

-To understand that all mollusks share certain characteristics.

Teacher Background

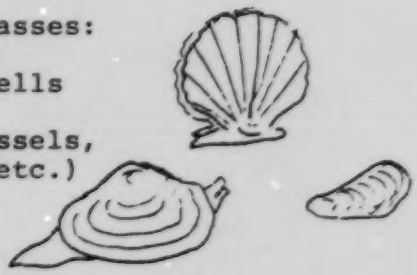
A Mollusk has a soft body, with (usually) a prominent muscular foot, used for locomotion.

The body is, in most cases, protected by a limy shell, which has been produced by the mollusk itself. In a few cases, the shell is internal/small/or lacking, (e.g. Nudibranches or "sea slugs"). However, these are not the ones you will have in your "shell" collection!

Phylum Molluska includes these classes:

Pelecypoda: Bivalve shells

(Clams, mussels, scallops, etc.)



Scaphopoda: Tooth shells

Gastropoda: Univalves, with conical or spiral shells, a distinct head, with tentacles.

(Snails, limpets)

Amphineura: With a shell of eight plates or valves.

(Chitons)

Cephalopoda: With a head which has long arms, bearing suction discs.

(Octopus and squid)

We will be considering only the Bivalves and Univalves and Chitons (eight valves or plates).

ACTIVITY 1.

Materials:

- -a variety of shells
- -photographs or other illustrations of the different kinds of mollusks
- -worksheet on mollusks

Procedure.

Either by giving students information or by drawing from what they already know, discuss with them the idea that some marine animals live inside very hard shells and travel about - or dig - with the large, muscular foot that each possesses. These animals come in a wide range of shapes and sizes, but they are all called mollusks. Tell the students that there are mollusks that can fool them, though, because some mollusks do not have a hard shell covering them - introduce octopuses and squids as examples, and, if students have seen them on the beach in previous years, mention nudibranchs.

After the group discussion, pass out the worksheet on mollusks and help students as needed.

If you plan to incorporate the worksheets into a student booklet, arrange to save each student's sheet in a cumulative file until the study is finished. Perhaps each child could start thinking about what he or she would like to use for cover illustrations!!

Unit 2. THE BIVALVES

Objectives

- -To learn what a bivalve is.
- -To be able to recognize a number of local species of bivalves.
- -To know how and where a bivalve usually lives.

ACTIVITY 1. WHAT IS A BIVALVE?

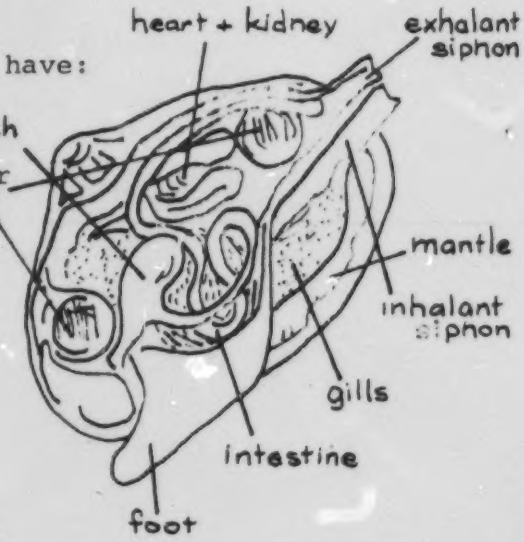
Objectives

-To understand what a bivalve looks like outside and inside.
-To learn that a bivalve has a internal system much like our own.

Teacher Background

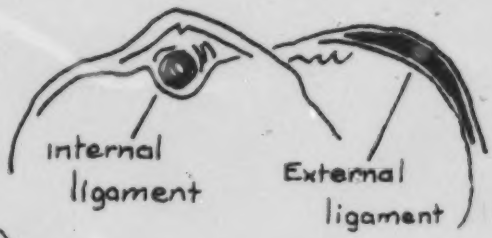
Most Bivalves have a soft body, with two valves (or shells) to cover and protect them.

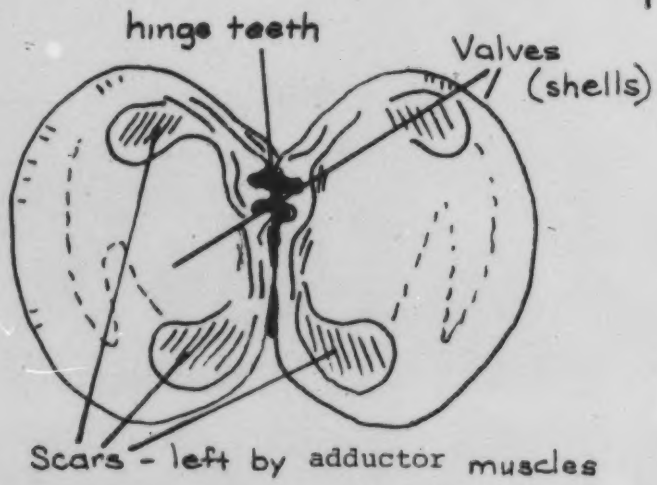
Clams and some other Bivalves have:
-a stomach
-mouth
-heart, kidneys and liver
-intestines
-gills (to breathe with)
-siphons (With one they bring in new water, with air, and food; with the other they send out water and wastes.)
-a mantle
-a foot (for digging down or moving through sand and mud)
-and two powerful "adductor" muscles that help hold and move the valves and leave the scars you see on the empty shells.

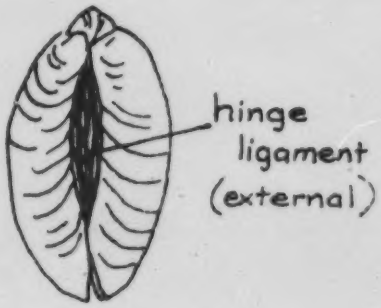


-But NO head

Hinge teeth and hinge ligaments help to hold the two valves of the Bivalve shell together.







Materials:

-poster on bivalves
-2 worksheets on bivalves

Procedure.

Using the poster discuss with students the idea that bivalves are one kind of mollusk or shell-bearing animal.

Early in the discussion, ask if anyone knows what the prefix bi- means? After arriving at the idea that it means "two", ask students what they think "bivalve" might mean. Bring them to the idea that the part of the word "-valve" refers to a part or section of the shell and thus a bivalve has two parts to its shell. Encourage students to think of as many words as they can that have the prefix bi-. Include such words as:

biannual
biennial
bicameral
bicentennial
bicycle
bilingual
bimanual
biweekly
bimonthly
binoculars
bipolar

Discuss the meanings of any of these words that are mentioned.

In the same or another discussion session, use the poster to point out to students the internal and external parts of a bivalve animal. After discussing them with the group, pass out the two worksheets on bivalves and give students help as necessary in completing them.

Activity 2. Blue Mussels (Mytilus edulis)

Objectives

-To recognize and know the name of the common blue mussel.
-To learn how the mussel lives and why it is important.

Teacher Background

There are other species of Mussels in Alaska, but on our beaches, they will be Mytilus edulis ("blue mussel").

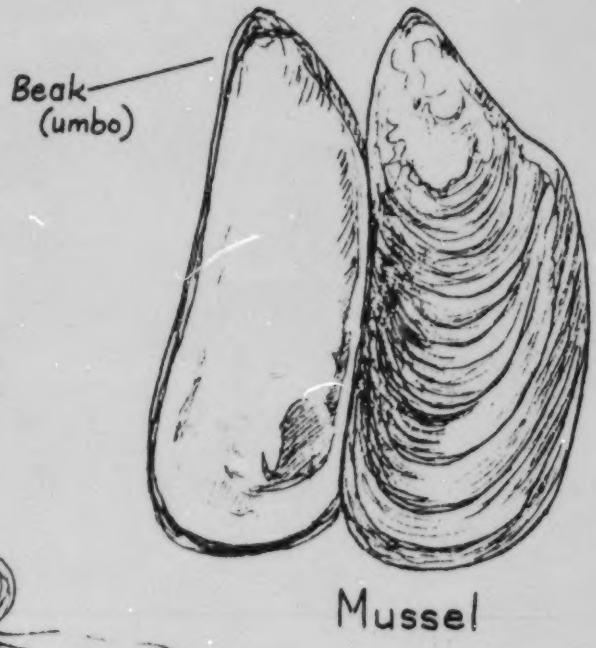
You will see these mussels almost everywhere, crowded together, in all sizes, and old shells cast up on the beach.

The valves of the mussel are generally black, immature shells often light brown, almost translucent, though they may be black at any size (age).

This bivalve has no hinge teeth, and only one siphon.

Since the mussel does not use its foot for digging or for travel, it does not have a large one.

Mussels anchor themselves to rocks, or pilings, (or wood - or cans - or other shells!), with strong "guy wires" or threads, called Byssus.



Clams and mussels obtain their food by straining out microscopic plants and animals ("plankton") from the sea water. For this reason, they are often called "filter feeders."

Unfortunately, some species of planktonic organisms, (e.g. Gonyaulax catanella), contain a poisonous chemical known as a saxitoxin, which remains and concentrates in the body of the clam or mussel which has ingested it. This poison can be very dangerous to any person who may eat the clam or mussel, as it works as a nerve poison and may interfere with the person's breathing. (It has caused death in a number of cases in SE Alaska.)

Although the presence of the poison is said to be associated with "red tide", it should be known that saxitoxin (PSP) may, in our area, be present in the clams and mussels at any time of the year and even when there is no indication of a "red tide." (Red tide occurs when millions and billions of the tiny animals are present to the point where they actually "color" the water red.) The presence of the poison is not predictable and can only be detected in the clams and mussels by a laboratory test which requires several hours. (This test is also used to "monitor" beaches for PSP** toxin and predict the presence of the poisonous organisms in the area.)
**PSP - Paralytic Shellfish Poisoning

Materials:

-mussel shells
-slide or other illustration showing a mussel
-worksheet on mussels
-live mussel in a pan of cold sea water (if possible)

Procedure.

Mussel shells often gather on our beaches in considerable windrows. If possible, collect a number of dead shells before beginning this activity so that each child will have a shell to examine closely.

If you have been able to secure such a collection of mussels (once gathered they can be used again year after year), pass out shells to the children. Review the idea of bivalves by asking them what kind of shell it is. Ask how they knew it was a bivalve. Point out the hinge, the muscle scars, and the differences in the outer and inner layers of the shell. If some of the shells have a few byssal threads still attached to them, point these out and lead children to think about how they might be used and why they are important to the mussel.

With a photo or other illustration or - best! - with a live mussel carefully kept in fresh, cold salt water, discuss how a mussel feeds. If you have a cooperative live animal, show the children the two round openings in the soft body of the animal - one for pulling water in and the other for expelling it. By dropping a few chalk type particles near the gaping shell, you might be able to demonstrate the movement of water into and out of the animal.

Be sure to discuss with children the idea of shellfish poisoning - what causes it, what it does, and the need for caution in eating mussels which absorb the toxin much more rapidly than do many other bivalves and thus can be especially poisonous.

After the class discussion and a shared examination of empty mussel shells, and, if possible, the live animal, distribute the worksheet on mussels to students. Read it with students or help them as needed.

Additional Activities with Mussels

In the Classroom

1. Science. If a small mussel can be detached and put into a pan of sea water and left undisturbed for a while, you may see it reach out its slender, specialized foot and attach a byssal thread, then reach back to the gland that holds its own brand of "epoxy" and back again, deftly placing the anchoring threads. (If this is done in class, the mussel must be kept in fresh salt water and in a cool place until you are

ready to look at it. If wrapped in damp paper towel and put in a plastic bag in the refrigerator, a mussel can be kept happily for several days.)

2. If empty mussel shells are available in abundance on shores near you, consider some of the ideas for art projects or math activities suggested at the end of this study guide and use only mussel shells for them.

AT THE BEACH

1. Science. Have students locate some mussels. With supervision, help them find some byssal threads, hopefully no longer being used by the mussel that put them out. Have children try to pull some of the bold threads to see how strong they are.

2. Encourage students to think about where they find mussels. Are they in patches or do they occur singly? Are they high or low in the intertidal zone. Look closely at a mussel bed and see if there are other kinds of animals living among the shells and byssal threads.

Activity 3. Scallops (Pectens and Chlamys)

Objective

-To recognize a scallop - both the shell and the soft animal and to know how it differs from other bivalves.

Teacher Background "Scallops"

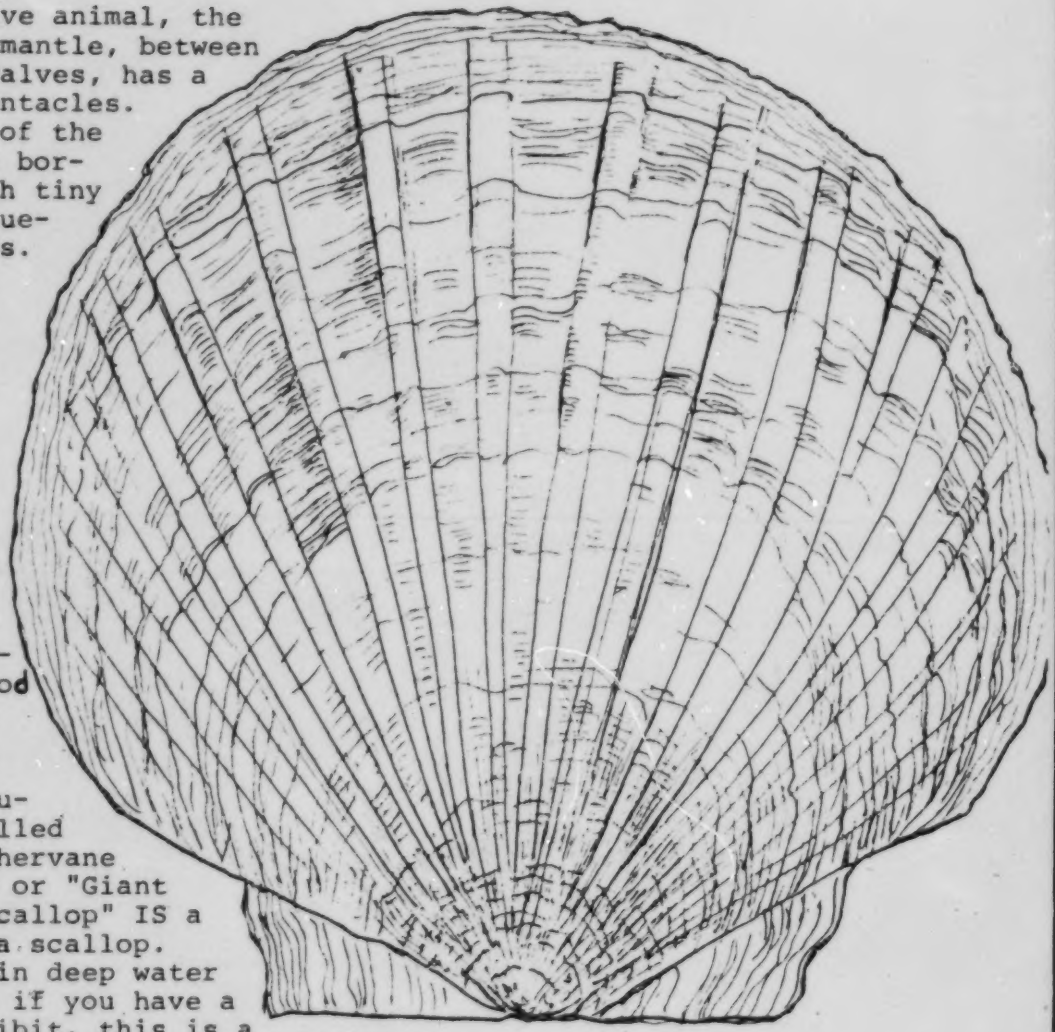
This beautiful Bivalve is the classic shell used in art and design, (and by the (Shell Oil Company).

We have four or five scallops in Alaska, but the shell you are most apt to find is Hinds' Scallop, (Chlamys Hindsii), a rather small scallop. The right valve is usually quite pink, and the left valve white or faintly pink. (Color is variable - they may be orange, yellow or rose color.)

The valves have wing-like "ears." On Hinds' Scallop one "ear" is much wider than the other.

(Chlamys Hindsii)
Hinds' Scallop

In the live animal, the "ruffly" mantle, between the two valves, has a row of tentacles. The edge of the mantle is bordered with tiny shiny, blue-green eyes.



Scallops swim by clapping their shells together, with a sort of "Jet propulsion."

They filter microscopic food from the water.

Pecten Caurinus, called the "Weathervane Scallop", or "Giant Pacific Scallop" IS a giant of a scallop. They are in deep water only, but if you have a shell exhibit, this is a big, "showy" shell that someone will surely bring.

Materials:

- -scallop shell
- -slide or other illustration showing scallops
- -worksheet on scallops

Procedure.

Using the background information given above and any examples you can find, discuss scallops, their shape, their characteristic eyes, and their behavior with the students. Then share the worksheet with them.

ACTIVITY 4. COCKLES "HEART COCKLE", "BASKET COCKLE"

Objectives

-To recognize a cockle.
-To know how and where a cockle lives.

Teacher Background

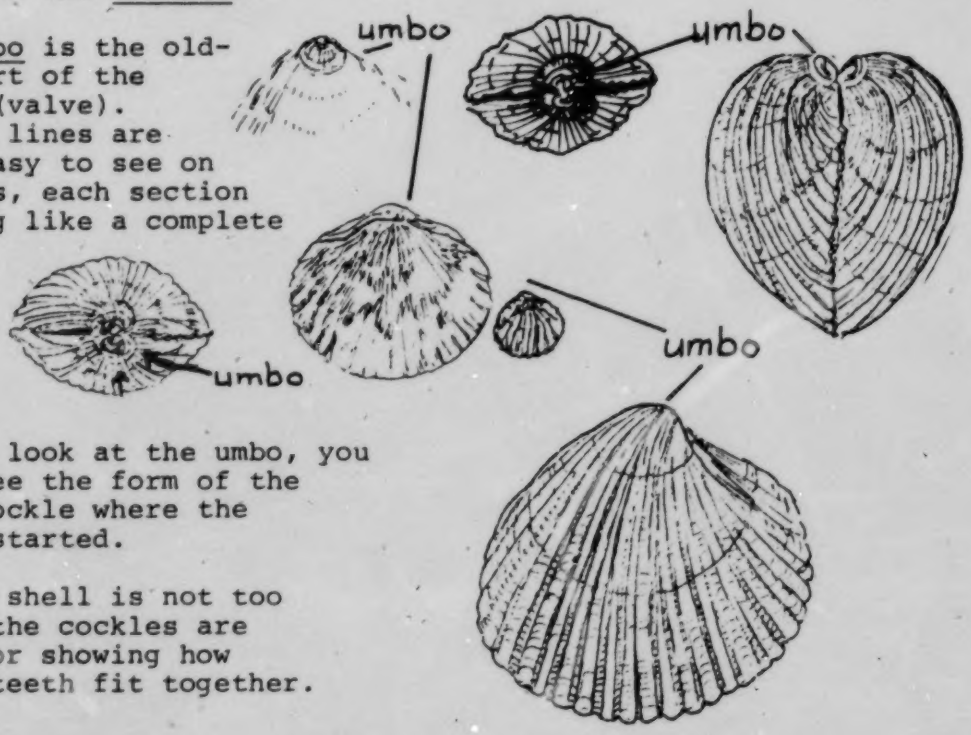
"Cockle", "heart cockle", and "basket cockle" are all names for Clinicardium cordis (most older books will use the name Cardium cordis).

There are other cockles Alaska, but this is the most common one.

Cockles are members of the Clam family, and have both "hinge teeth" and "hinge ligaments".

You will find cockle shells of all sizes (ages). The young specimens are often very prettily marked, many yellow, with brown mottling inside. The very tiny ones may have a blue color on the umbones.

The Umbo is the oldest part of the shell (valve). Growth lines are very easy to see on cockles, each section looking like a complete shell.



If you look at the umbo, you will see the form of the tiny cockle where the shell started.

If the shell is not too worn, the cockles are good for showing how hinge teeth fit together.

Materials:
-cockle shells
-worksheet on cockles

Procedure.

Working from shells and with the worksheet, examine the cockle and its shell with students. Point out the umbo, ridges that make growth rings (just like the annual rings visible in cross-sections of tree trunks), and the shape, texture and color of the shell.

Additional Activities - Cockles

AT THE BEACH

1. Science. Encourage children to look for cockles. They may be found - live - either lying exposed on a sandy surface or buried beneath the surface.

2. Science. If you find a cockle at the beach, place it in a bucket of cold sea water. If you are lucky, you will see the cockle extend its large muscular foot, a foot that it uses to dig itself into the sand and that it can use to throw itself over and over cart-wheel style if it has been lying on the surface and is approached by a starfish that would like to eat it.

Activity 5. Clams

Objectives

-To learn that there are many kinds of clams.
-To learn how they live and how they feed.
-To learn to recognize some of the common, local intertidal clams.

Teacher Background

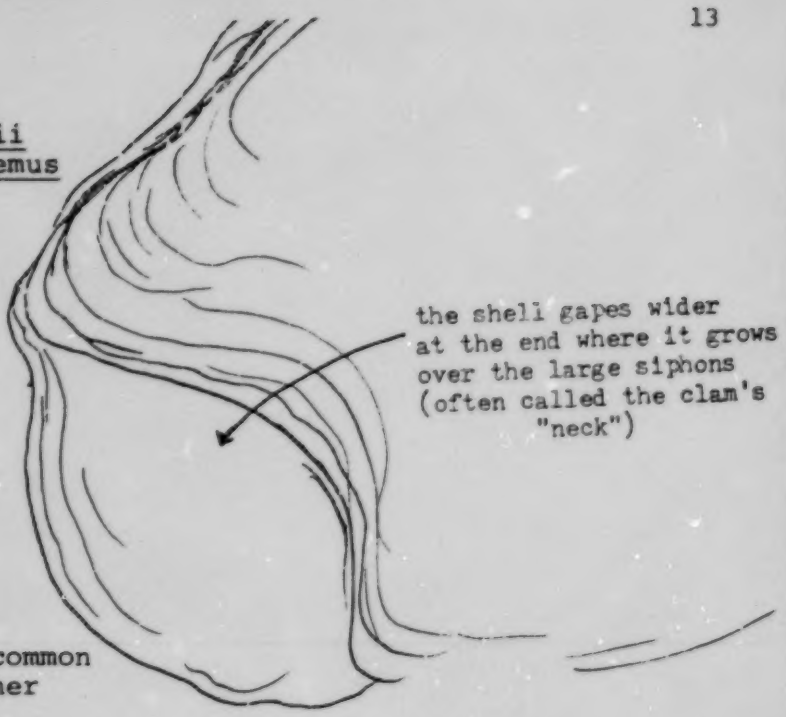
There are numerous species of clams on Alaskan beaches. What follows is a brief description of some, but not all of them.

Like Mya truncata, he never does get it all inside.

Picture much reduced.

Tresus capex
(=Schizothaerus nuttallii subsp. capex =Schizothaemus capex)

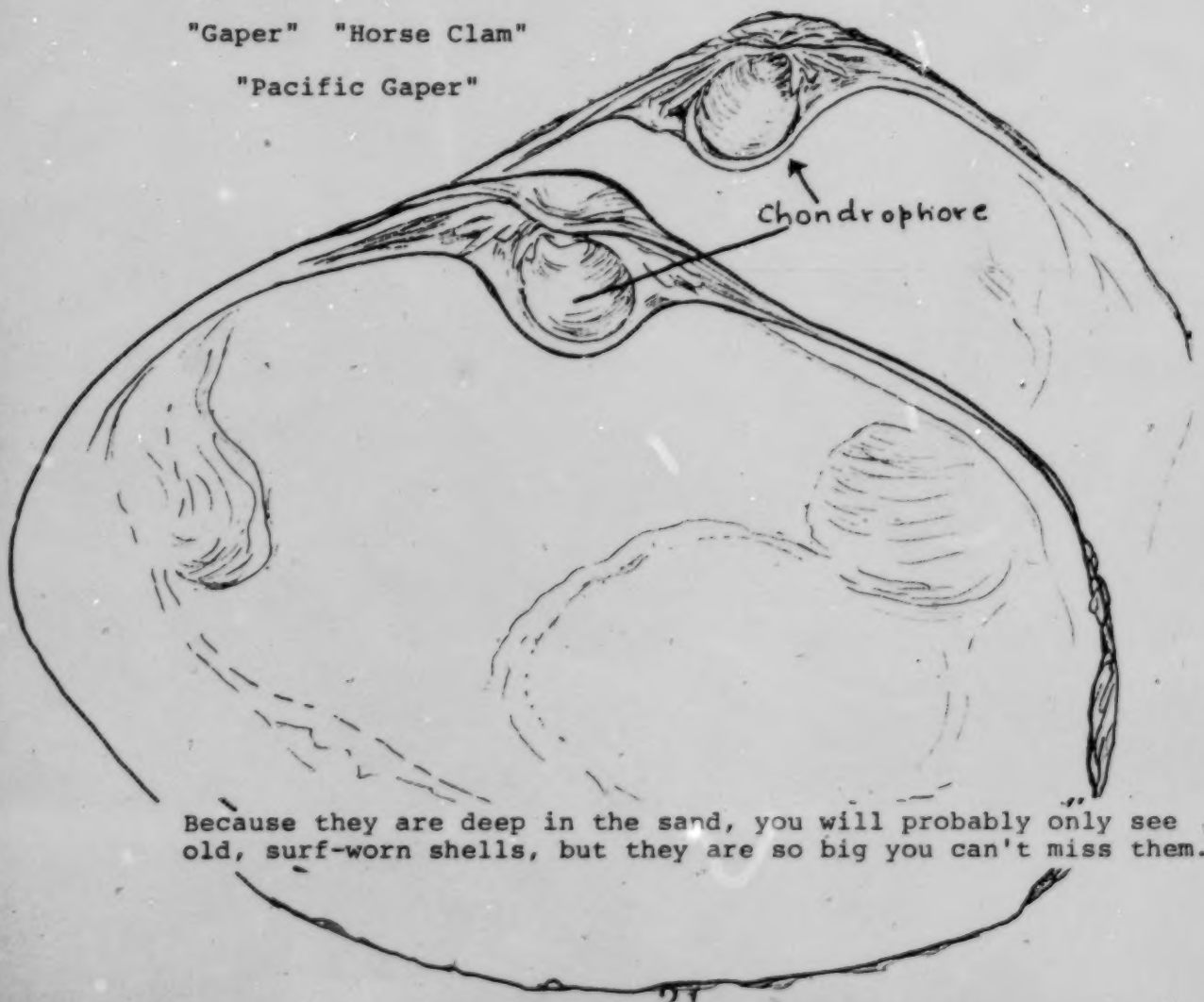
-not all books will have the same name for this one



There are also several common names (most used for other clams as well) -

"Gaper" "Horse Clam"

"Pacific Gaper"

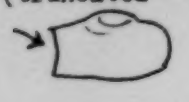


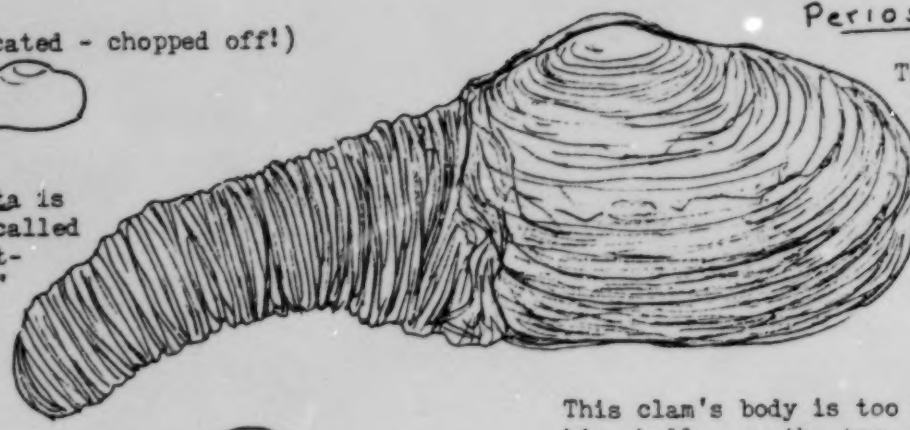
Because they are deep in the sand, you will probably only see old, surf-worn shells, but they are so big you can't miss them.

Mya truncata

The valves and siphons are covered with a paper-like skin, or Periostracum

(truncated - chopped off!)





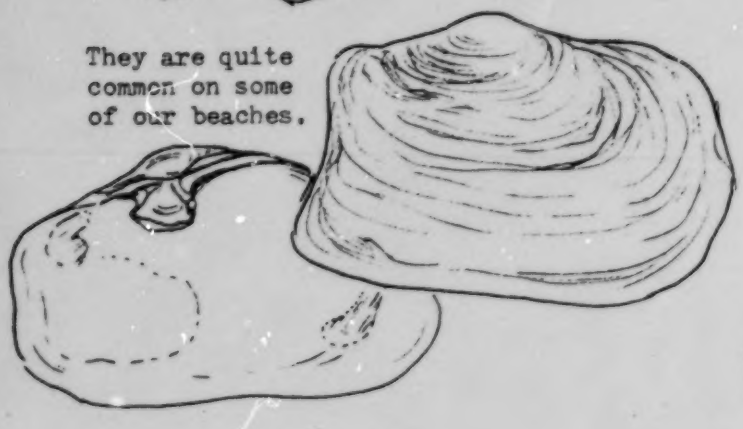
The long siphons look like a neck - but are really at the back - (posterior) end.

Mya truncata is sometimes called "Blunt Soft-Shell Clam"

or

"Truncated Mya"

They are quite common on some of our beaches.



This clam's body is too big for his shell - so the two valves have a wide gap and never do really fit together. The two valves are unequal - one valve is always slightly longer than the other.

When you see the shells on the beach they look a little like tiny "Geoducks".

Mya arenaria

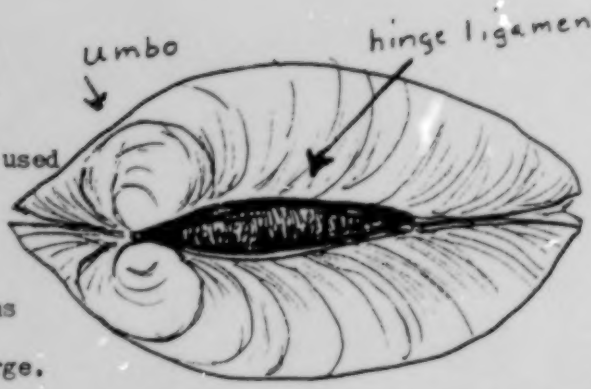
"Soft-Shell Clam"

This Mya has a Chondrophore very much like the Mya truncata - But it does not have the blunt, truncated end.

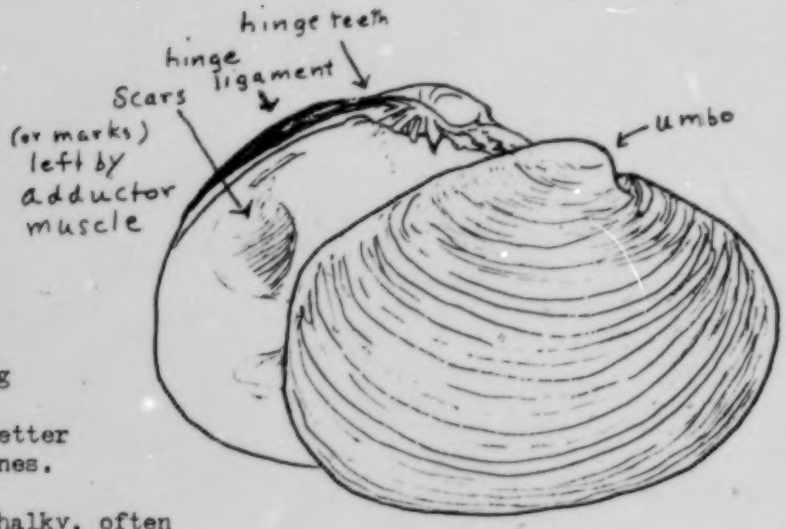
Saxidomus giganteus

"Butter Clam", "Washington Clam", "Smooth Washington Clam".

Since its common names are used for a variety of other clams, it might be a good idea for the children to call this clam by its name, Saxidomus, which means a rock house - giganteus, which, of course, means large.



Saxidomus has a very heavy external hinge ligament, leather-like and rather rounded, which becomes brittle when old and dry.



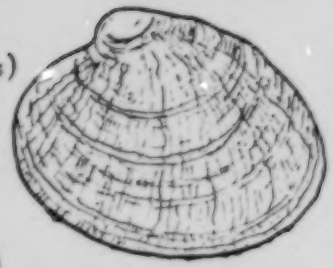
This is one of the larger, and more common shells to be seen, often old and weathered, on our beaches. The shells, being heavy, survive the wearing action of rocks and tide better than do the more fragile ones.

The old shells are quite chalky, often with growth lines, teeth, etc., worn off.

With matching valves, Saxidomus has good hinge teeth to fit together (if the shell is not too old and worn).

Saxidomus may grow to five inches. The shells illustrated are rather small ones.

Protothaca staminea (= Paphia staminea in older texts)

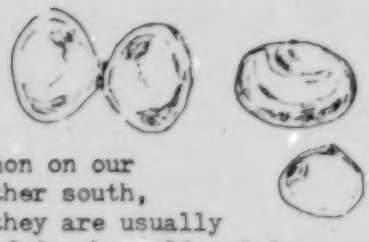


"Steamer Clam",
"Little Neck"

Protothaca is fairly abundant in our area. They are said to take about ten years to reach full size. You will find "adult" animals as small as one inch.

Young specimens sometimes have zigzag markings. The siphons ("necks") are very short, so Protothaca is never very deep in the sand. The valves are thick and strong. The hinge ligament is external, and the hinge teeth are distinct, - excellent for showing how hinge teeth interlock.

Macoma inconspicua (Very like, and possibly not distinct from, the Atlantic Coast Macoma balthica, - at least so classed in some books.)



"Little Pink Clam", "Inconspicuous Macoma".

These are the lovely little pink shells, so common on our beaches. Possibly they are "inconspicuous" farther south, where they are sun-bleached to white, but here they are usually rose-pink, (sometimes yellow). They do tend to fade when old and dry. Rubbing them lightly with a bit of baby oil, or mineral oil, will help to keep the bright color, without making them unsuitable for a "scientific" collection, (as laquer or plastic finish would).

Since the tiny clam is not strong enough to dig very deeply into the mud or sand, the live ones are quite near the surface.

You will find other small white clams, not so easily recognized as the other shells illustrated, - but unmistakably Clams.

macoma nasuta
"Bent-nose Clam"

macoma irus
(= m. inquinata)

Bankia setacea

("Northwest Shipworm", "Pacific Shipworm")

Called "Shipworm" because of its long, worm-like body, Bankia is really a Clam!

It is our most common wood borer. When young, it settles on wood, such as a submerged log, or a wooden boat, (They were named "shipworms" back in the days when big ships were built of wood), and starts boring a hole with its two small shells (valves). The rest of its life it keeps working at its burrow, which gets larger as the clam gets larger, and longer and more worm-like. It may grow to be three feet long. It lines its burrow with a shell-like lining as it goes.

Its food is plankton, brought in by the water, though it may get some nutrition from the wood it eats, as it cuts its burrow.

Look at an old log on the beach. You will probably find old tunnels made by shipworms. Some will still have the shell-like lining.

Sometimes other small clams (e.g. Saxicava) will use the old burrows as a "home".

Alaska has other borers who grind holes or tunnels in rock, but we are not apt to see their burrows.

* * * * * * * * * * *

Hiatella arctica

("Arctic Saxicava")

Quite common on our beaches, this clam is able to survive being brought into the classroom for observation. (He should have some sand or mud in the pan, as well as salt water.)

Shells are variable!

Materials;
-clam shells
-worksheets

Procedure.

In studying any marine animals, the real place to study them is where they live - at the shore. It helps, however, to familiarize students with the animals, what they look like and where they live before making a field trip. So, using the above background information, available specimens and worksheets, lead students to a basic familiarity with clams and their differences.

Additional Activities. Clams

1. Science. Either at the beach or in the classroom, place a live clam in a bucket of fresh, cold sea water and watch to see if it extends its foot or its siphon. Introduce a few small particles to the water and see if they are drawn into the clam through the incurrent siphon.

2. Cooking. Make clam chowder! (with canned clams, to avoid Paralytic Shellfish Poisoning.)
   This is to provide a cooking experience and a "taste treat." Have the children bring the equipment and ingredients and do the planning with them. Write the recipe on chart paper and provide a reading experience.

   Equipment:

big pot	spoons
hot plate	pot to cook potatoes
stirring spoon	cutting knife
servings bowls/cups	potato peeler
measuring spoons	ladle to serve

   Ingredients: Quantities are an estimate only; feel free to add or delete.

clams, 2-4 cans	onions, 2-3 medium
bacon, 10 slices	milk, 2 gallons
potatoes, 6-8 large	flour, 4 tablespoons
celery, 6 stalks	salt and pepper

   Directions:

   1. Cut bacon into chunks, cook slowly in pot, then remove.

   2. Chop onion and celery, saute in "bacon drippings" til tender.

   3. Cook potatoes separately in a pot of water...(as little as possible without burning dry--remaining water and vitamins will go into chowder). Dice after cooking.

4. In big pot, add 4 tablespoons flour to onion and celery mixture.

5. Return bacon to the pot, add clams, milk, leftover potato water, cooked potatoes diced, and salt and pepper to taste.

   Serve in bowls.
   Have crackers too if you want.

3. Math, matching activities using dead, empty shells.

AT THE BEACH

1. Science. Bivalves such as clams that burrow into the sand or mud, must extend their siphons up to the surface to feed. Encourage students to walk over sandy or muddy areas of the beach carefully, looking for siphon tips and their holes as they go. If they find a small hole in the sand, or see a siphon sticking up, the pressure of a foot near the hole will cause the animal to retract its siphon and as it does so, the water that was in the siphon will squirt upward - sometimes like a fountain. After observing this, dig carefully to see if you can uncover the clam. If you are successful, examine it, decide what clam it is if you can, then - unless you want to put it in a bucket of salt water to observe it for a while - put it back in its hole and cover it once again.

2. Science. See how many different kinds of clams students can find. Encourage them to think about where they find them, whether they are dead or alive. In general, help students realize where these animals live and what they must have in order to survive.

Unit 3. UNIVALVES

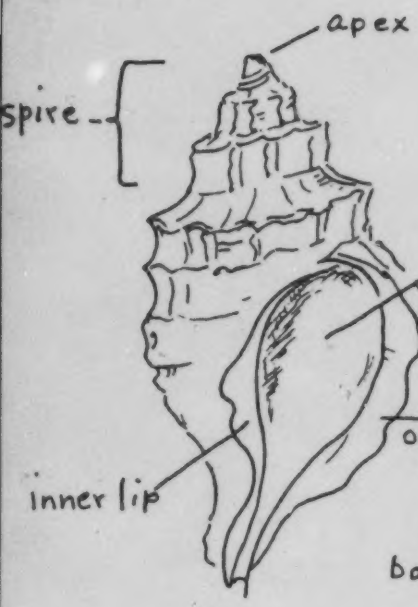
Objectives

-To learn what a univalve is.
-To know how and where a univalve usually lives.
-To be able to recognize a number of local species of univalves.

ACTIVITY 1. WHAT IS A UNIVALVE?

Objective

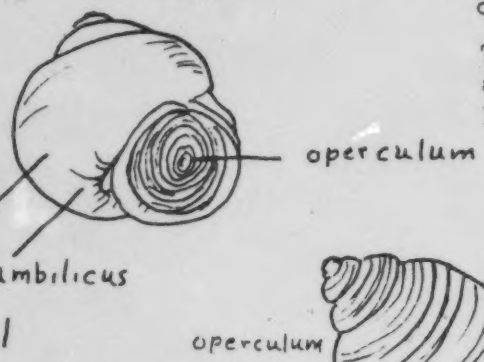
-To understand the shape of a univalve and the vocabulary used to describe it.

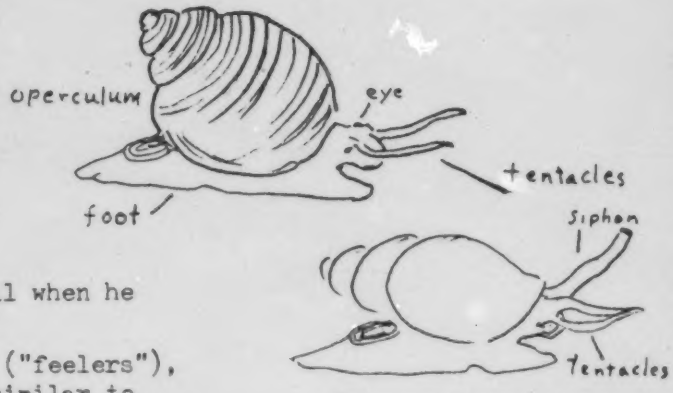


Gastropods: In the gastropods the shell is single (univalve), and is usually spiral. But sometimes, it is nearly flat, or a simple cone, as in limpets.

The name Gastropod means "stomach foot", the main part of the body being the foot, on and with which the animal travels.

The Limpet does not need an operculum; he just pulls down and hangs on!





In the Snails (whelks, periwinkles, etc.), on the rear of the foot, (what looks like his "tail") is attached the operculum, which the snail uses as a door to close the entrance to the shell when he draws back into his shell.

Most gastropods have heads, tentacles ("feelers"), and eyes, as well as internal organs similar to a clam's, arranged to fit the contour of the shell.

The periostracum, (epidermis, or outer skin), may be laquer-like, very thin - like a wash of color -, velvety, or even hairy or bristly (as in the Tritons).

Some gastropods also have siphons to draw in water.

The shape of the operculum will, of course, depend on the shape of the opening to be closed. Some are paper-thin and some are very thick and horny.

The Radula is a long, file-like tongue in the mouth of many gastropods, used by some to drill holes - into other creatures - and by some to scrape up microscopic plant food from rocks, etc.

Materials:
-poster on univalves
-worksheet on univalves

Procedure.

Using the poster discuss with students the shape and parts of a univalve. Early in the discussion ask students to think about the word "univalve." Already having learned about bivalves, they should be able to guess at the meaning of the word. After they understand that a univalve is a shelled animal with only one part or valve to its hard, protective covering, ask them to think of other words with the prefix "uni-." Include such words as:

unicorn
unicolor
unicameral
unicycle
uniform
unification
unilingual
unique
unit
united
universe

Discuss the meaning of each word and the use of the prefix in each one.

Looking at the poster, point out to students the labeled, important parts of the shell. Explain that internally the univalve has many of the same structures found in a bivalve, but that they are twisted into the spiral shell. Externally the univalve has tentacles and eyes, both of which the bivalve lacks. After the discussion, pass out the worksheet on univalves, helping students with it as needed, then adding it to each students cumulative folder.

Activity 2. Moon Snails

Objectives

-To learn the shape, size, and color of this snail.
-To learn where and how it lives and how it lays its eggs.

Materials:
-moon snail shell or photo/illustration of it
-worksheet

Procedure.

Use available materials and appropriate worksheet to help students learn to recognize this shell which they will find on our beaches if they are lucky.

Moon Snails

Natica clausa and Lunatia pallida

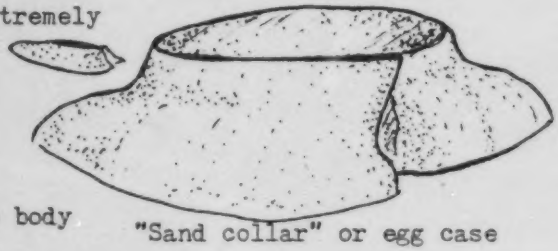
"Arctic Natica", "Moon Snail" — "Pale Northern Moon Snail"

Natica, most often seen here, has a light brown, smooth Periostracum, though beach worn shells may be white.

Natica clausa, or "Arctic Natica"

Moon snails are often used by Hermit Crabs, when they outgrow the periwinkles and margarites.

Moon snails have an extremely large foot and mantle, which, when spread out, is much larger than the shell. However, the moon snail is able to pull all this oversize body back inside the shell.



"Sand collar" or egg case

Lunatia pallida "Pale Northern Moon Snail"

Sometimes the perfectly round holes you see in clam shells are made by the radula of a moon snail. The moon snail is a carnivore (meat eater), feeding on clams and other creatures.

The "sand collar" is the egg case of the moon snail. It is large, more or less in the shape of the snail's expanded body, and looks something like a "plumber's friend" (rubber suction cup). The eggs are held together by a gelatinous "glue", encrusted with sand or fine crushed shell. (The texture will vary with the beach.)

Whelks

Nucella lamellosa (= Thais lamellosa)

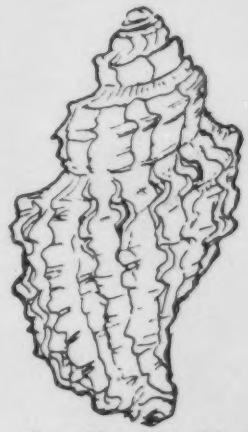
These are extremely variable, some shells with flaring, frilled sculpture, and some quite smooth and heavy. They also have a variety of colors and markings. There are almost as many common names as forms! -

"Wrinkled Thais"
"Frilled Dogwinkle"
"Wrinkled Purple"

(Purple for the dye made from the crushed shell, not the color of the shell, itself.)

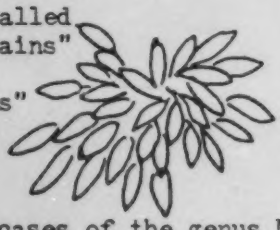
The "whelks" are some of our most decorative univalves. We have a number of small whelk-like snails, which may be difficult to tell apart.

Operculum



Nucella lamellosa (= Thais lamellosa)

called "wheat grains" or "sea oats"



Egg cases of the genus Nucella (= Thais)

Members of the Thais family are also carnivores, feeding on bivalves by drilling holes and sucking out the soft bodies.

ACTIVITY 3. WHELKS (THAIS LAMELLOSA)

Objectives

-To learn that not all shells of the same kind look alike.
-To learn the variations in one kind of shell and to be able to know the shell when it is seen.

Materials:
-a number of shells of the snail Thais lamellosa, including ones that show considerable variation from each other (these may be included in a permanent class collection or may be observed as live shells during the field trip)
-worksheet

Procedure.

Point out to students as they examine these shells or illustrative material that just like people are all individuals and differ in appearance from one shell to the nest, so can shells. Prepare students to look for this when they are at the beach; ask them to see how many "different" colored or frilled Thais shells they can find.

When discussing this particular univalve, remind students that many marine animals don't have common, easy-to-say and easy-to-remember names. Thais lamellosa is one of these - and students may find it fun to learn its scientific name!

ACTIVITY 4. HAIRY TRITON

Objective

-To learn to recognize one of the large, common Alaskan univalves.

Teacher Background

The hairy triton occurs with some frequency on Alaskan beaches and students may well find them during the field trip. Their shell is extremely delicate and is a light pink color. It is covered with a brown periostracum that has many stiff, bristle-like projections on it.

Materials:
-worksheet
-shell specimens if available

Procedure.

The worksheet is, hopefully, self-contained and self-explanatory. Help students with it as needed.

Activity 5. Limpets

Objectives

-To recognize that a limpet is a univalve even if it doesn't have an apparent spiral to its shell.
-To learn to recognize limpets, to know where to look for them, and to understand how they feed.

Teacher Background

Acmaea and
Collisella species

"Limpets"
"Chinaman's Hats"

Because most Limpets are extremely variable, it is usually difficult to tell the species apart.

We have several species, (and maybe hybrids!).

They are common on rocks - - where they "cling like a limpet."

Acmaea mitra
"White Cap Limpet"

Limpets are vegetarian, "grazing" on algae.

"Keyhole Limpet"
Diodora aspera

Tiny ones are often seen on eelgrass and seaweed.

Materials:
- -limpets to examine
- -worksheets on limpets

Procedure.

Most students will already be familiar with limpets. Stress with them that they are a kind of univalve. When examining live limpets at the shore, show students the tiny, slit-like mouth on the underside of the soft animal and explain how limpets use a radula to scrape algae off the rocks. Use the worksheet on limpets.

Additional Activities.

AT THE BEACH

1. Science. Limpets can move surprisingly fast. Try this experiment.

   Materials: chalk

   When you arrive with your students at the beach, look for limpets that are high in the intertidal zone - one species lives on large rocks almost at the upper tide limit. If you find some, draw a chalk circle around several on different rocks or in different locations. At the same time, make a chalk mark on the shell of the limpet.

   After an interval - perhaps an hour - return to the limpet area and check to see if the marked limpets have moved. If you wish, calculate their rate of travel. Note the direction of travel too - many limpets feed at night and move to the undersides of rocks during the daytime.

Activity 6. Other Univalves

Teacher Background

In addition to the univalves already mentioned, several others may be found on local beaches. Here is information on some of them. You may want to study them in the classroom with your students. Be sure to point out any you find when you are at the shore, noting where they occur, what they look like and how they behave.

A large shell you may find is Neptunea lyrata.

These shells are often used as homes by really large hermit crabs.

Neptunea lyrata

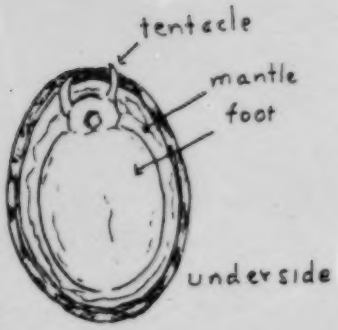
"Northwest Neptune"

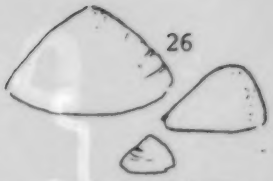
"Lyrate Neptune"

"Neptune Whelk"

Acmaea and
Collisella species

"Limpets"
"Chinaman's Hats"





Acmaea mitra
"White Cap Limpet"

Because most Limpets are extremely variable, it is usually difficult to tell the species apart.

We have several species, (and maybe hybrids!).

They are common on rocks -- where they "cling like a limpet".

Limpets are vegetarian, "grazing" on algae.

Tiny ones are often seen on eelgrass and seaweed

"Keyhole Limpet"
Diodora aspera

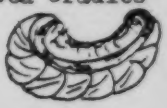
* * * * * *

Chitons

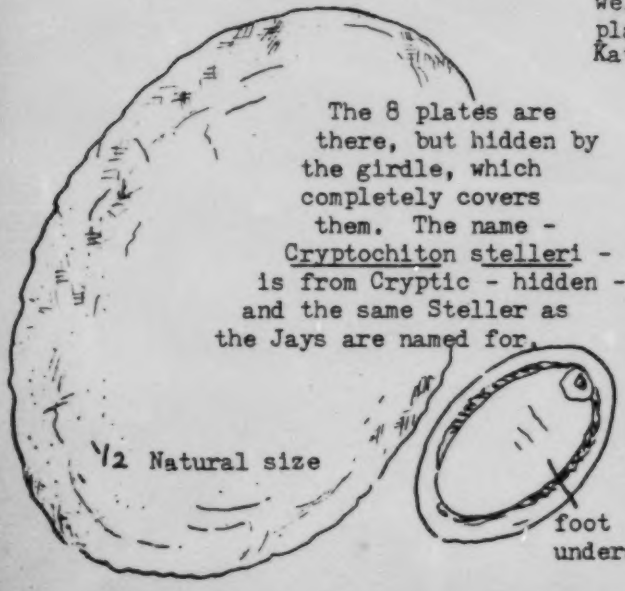
Chitons are neither "bivalves" or "univalves". They have eight valves, or plates.

Our two largest Chitons, the "Black Katy Chiton" and the huge "Gum Boots" have long been used for food by the Southeast Alaska Indians.

Some are called "Sea Cradles"



Cryptochiton stelleri



The 8 plates are there, but hidden by the girdle, which completely covers them. The name - Cryptochiton stelleri - is from Cryptic - hidden - and the same Steller as the Jays are named for.

The black, leather-like girdle often grows well up on the plates of a Katy Chiton.

Katharina tunicata
"Black Katy Chiton"

Tonicella lineata - "Lined Chiton" - one of our more beautiful Chitons.

If removed from the rock, they curl up like an armadillo.

The Little Snails - "Margarites", "Top snails", "Chink-Shells", "Periwinkles"

These snails live on plants, mostly algae too small for us to see except as a green color on rocks and shells which they scrape off with their Radulas.

Margarites pupillus (Margarites - pearl pupillus - doll-like)

Margarites pupillus - "Margarite" or "Pearly Snail"

One of the very pretty ones, the "Puppet Margarite" is pinkish when wet, and pink or bluish iridescent inside. (When looking at shells in the classroom, keeping them in a dish of water will revive the pink color.)

Lacuna porrecta

"Wide-Chink"

It uses the round operculum to keep in moisture - and keep out enemies.

(both snail and egg cases drawn slightly larger than life)

Lacuna porrecta - "Wide-Chink Shell"

This is a very small, smooth snail, usually dark brown. You might not notice it, but you will notice its egg cases. They look like tiny yellow doughnuts! (Sometimes light green). You will find them on seaweed. If you look at them with a hand lens (magnifying glass), you can see many tiny dots, which are the eggs, inside the round, jelly-like egg cases.

Littorina sitkana - "Sitka Periwinkle"

The Sitka Periwinkle comes in a variety of colors and markings, often dark brown, sometimes with orange or gold bands.

Intertidal snails, Periwinkles are found high up on the beach - on rocks, pilings, driftwood, or seaweed. If the sun becomes too warm when the tide is out, they can close their operculums and crawl down under the moist seaweed.

Littorina sitkana

"Sitka Periwinkle"

"Sitka Littorine"

Periwinkles not only can stay out of water for a long time; they need to be out of the water part of the time (being something between a sea-creature and a land-creature). The Littorines are able to spend about half their time out of water.

If you have them in a pan of water, you will notice that they climb up the side - and sometimes right on out!

Unit 4. CHITONS

Objectives

-To understand what a chiton is.
-To be able to recognize a number of local species.
-To know how and where a chiton usually lives.

ACTIVITY 1. WHAT IS A CHITON?

Objectives

-To learn what a chiton looks like.
-To be able to distinguish between several kinds of chitons.

Materials:
-poster on chitons
-worksheets
-additional illustrative material as available (slides, specimens)

Procedure.

Using the poster, tell children that a chiton - like bivalves and snails - is a kind of mollusc. See if they can figure out what the three kinds of animals have in common (external shell, soft body; chitons like snails and many bivalves have a large, muscular foot). Have someone count the number of plates, or parts to the shell, on a chiton and make it clear that chitons ALWAYS have eight plates on the back of the animal - but sometimes they may be partially or completely hidden from view!

Talk with the children about the shape of the chiton and how it differs from that of bivalves and univalves. Lead them to put forth ideas about the kind of life to which a chiton might be best adapted. Ask children if they have seen chitons at the beach and if so where they have found them. Bring the discussion to the idea that chitons are well suited for living on rocks in the intertidal zone where sometimes there are strong waves. With their flexibility and low profile, they can cling tightly to rocks and offer little resistance to waves that might otherwise sweep them away.

Point out to children that some kinds of chitons, notably gumboots and the black chiton Katherina tunicata, have long been valued by Alaska natives as food.

After completing the class discussion, pass out the worksheet on chitons and have students complete it with whatever teacher help is required.

Additional Activities - Mollusks in General

While some activities are appropriate to the study of specific bivalves or univalves, many more can be incorporated into the unit in a more general way - either because they involve more than one kind of shell or because they enhance the general concepts and attitudes involved in a study of life in the sea.

Following are suggestions for many activities that can be used in endless ways to enhance and enliven your classroom study of the sea.

Activities:

I. Science

A. Shell Exploration:

The following activities can be done with
Have magnifying glasses available.

1. Find 3 different kinds of bivalves. (Remind students that the shells are "valves" and "bi" means 2).

2. Find 2 or more univalves.

3. Find 3 kinds of clams.

4. Trace around the largest clam you can find, the smallest.

5. Find an old shell that has been used (or is being used) by some other creature. (not the original owner).

6. Find a shell that has a round hole drilled in it. Who may have made it?

7. Find a shell that has teeth that fit together like a hinge.

8. Find a shell that looks like a valentine (heart) when the two halves fit together.

9. Find some shells (or other creatures' "home") that look crowded.

10. Feel the different shells, rub them gently.
Are they smooth? rough? ridged? grooved?

11. Explore the different shapes and sizes by tracing around the shells.

12. Group the shells into different piles and explain WHY he chose such piles. Color? Size? Shape?

13. Have a pile of bivalve shells that are separated, group the shells into matching pairs.

Activities:

I. Science (cont'd)

B. Bring in a bucket or large pan with "live" shells and creatures in their salt water invironment or "habitat".

WARNING - All these creatures are cold water creatures and cannot survive in hot classrooms. They should be returned to the sea at the end of the day or kept in a cool place with new sea water added.

1. Observe:

a. What makes the creature "alive"?

b. What objects are not "alive"?

c. How do the creatures move?

d. Look for the different "parts" of the living creatures.

e. Watch a snail (periwinkle etc.) pull in its foot and close the door with the operculum.

f. If there are barnacles, observe them feeding.

C. "Sink and Float" Center

Collect objects for children to test whether whey will sink or float. Have a large pan of water to test the objects.

Example of objects:

piece of driftwood	piece of paper
wooden spoon	cork
rock	rock with barnacles
shell	feather
hunk of clay	seaweed
leaf	glass
scissors	bark
pencils	string
eraser	foil
cellophane	empty can

Have the students record their findings.

D. Make a shell exhibit to share with the entire school.

E. Shell-Word Match Game: Have shells and cards with the names and have students pair them. Examples: mussel, clam, scallop, cockle, pink clam, whelk, limpet, barnacle.

Activities:

II. Language Arts

A. Reading

1. Books

a. Swimmy by Leo Lionni
Pantheon

Good Story, illustrations could be used to motivate finger painting with an underwater theme.

b. Seashore Story by Taro Yashima
Viking
A Japanese legend.

c. Pagoo by Holling C. Holling
Houghton Mifflin

Fantastic illustrations! A sea week classic, has been made into a movie.

d. The Little Island by Golden MacDonald

e. Hide and Seek Fog by Alvin Tresselt

f. Houses from the Sea by Alice E. Gouday
Scribner
Well written, mentions some shells found on our beaches.

g. Charlie Brown's Super Book of Questions and Answers
Scholastic Book Services - Has a section on "Animals with No Bones" and discusses shells.

h. Charlie Brown's Super Book of Things to Do and Collect
Random House - Has a section on collecting shells and several accompanying activities.

Activities:

II. Language Arts (cont'd)

2. Vocabulary Development

a. Discuss bivalve and univalve and their meanings, and what the prefixes bi and uni mean. Make words lists of "bi" words and "uni" words.

Possible words are:

biannual	unicorn
biennial	unicolor
bicameral	uniform
bicentennial	unicameral
bicycle	unicycle
bifocal	unification
bilingual	unilingual
bimanual	unique
biweekly	unit
bimonthly	united
binoculars	universe
bipolar	

5. Make Sea-Week bookmarks

6. Make a scrapbook of sea oriented pictures, write captions underneath. Share them with one another.

B. Creative writing

1. Story starters:

Suddenly,before my eyes, the seashell began to grow.

My dog began barking fiercely at the strange creature that was floating towards shore.

I was beachcombing one foggy afternoon and suddenly bumped into.....

The frothy wave leaped up onto the dock and carried me away on its crest.

I always thought sea monsters were make believe until....

Activities:

II. Language Arts (cont'd)

1. Story starters (Cont'd)

I was slowly opening the clam shell and to my great amazement discovered....

As I was wiggling my toes in the sand, my foot struck something strange.

I was studying this bivalve shell, when it suddenly moved its two halves and said....

I was exploring a beach one rainy afternoon when I suddenly began to shrink! Soon I was the size of a periwinkle.

I find the inside of a univalve shell the most wonderful home because....

2. Writing Cinquain - simple 5-line poems

Line One - a noun (person, place, or thing)
One Word

Line Two - 2 adjectives that tell about the noun
Separate adjectives with commas

Line Three - 3 verbs that tell what the noun does
Separate verbs with commas

Line Four - a short phrase about the noun

Line Five - repeat the noun or write a synonym

Example:
Seashore
Sandy, stormy
Rests, storms, splashes
Changes with the ocean
Seashore

Write several as a class or work in small groups. Cinquain is fun to write and second graders can do it successfully.

3. Writing "Tongue Twisters"

She sells seashells by the seashore.

Activities:

II. Language Arts (Cont'd)

C. Poetry - Have the poems on chart paper, read them to the class, have the children read them orally. Have the children memorize parts or all of a poem, this will aid in articulation and verbalization.

Have the children act out parts of a poem. e.g. "sand in the eyes and the ears and the nose..."

Have the children illustrate a poem. e.g. "The Sea Princess"

"At the Seashore" Aileen Fisher

Waves have fingers
Without a hand,
Fingers stretching
Across the sand,
Strewing shells
On the hard wet shore,
Then drawing back
To bring some more

When We Were Very Young A.A. Milne
(Excerpt from "Sand-Between-The-Toes"

I went down to the shouting sea,
Taking Christopher down with me,
For Nurse had given us sixpence each-
And down we went to the beach.

We had sand in the eyes and
the ears and the nose,
And sand in the hair, and
sand-between-the-toes.
Whenever a good nor'wester blows,
Christopher is certain of
Sand-between-the-toes.

Activities:

II. Language Arts (Cont'd)

"The Eagle" by Alfred Tennyson

He clasps the crag with
crooked hands;
Close to the sun in lonely
lands,
Ringed with the azure world,
he stands.

The wrinkled sea beneath
him crawls;
He watches from his
mountain walls,
And like a thunderbolt
he falls.

"The Sea Princess" by Katherine Pile

from The Sound of Poetry - Allyn & Bacon

In a garden of shining sea-weed,
Set round with twisted shells,
Under the deeps of the ocean,
The little sea princess dwells.

Sometimes she sees the shadow
Of a great whale passing by,
Or a white-winged vessel sailing
Between the sea and sky.

Without the palace, her sea horse
Feeds in his crystal stall,
And fishes, with scales that glisten,
Come leaping forth at her call.

And when the day has faded
From over the lonesome deep,
In a shell as smooth as satin
The princess is rocked to sleep.

Activities:

II. Language Arts (Cont'd)

"Treasures" by Mary Dixon Thayer

from The Sound of Poetry - Allyn & Bacon

Down on the beach when the tide is out
Beautiful things lie all about--
Rubies and diamonds and shells and pearls,
Starfish, oysters, and mermaid's curls;
Slabs of black marble cut in the sand,
Veined and smoothed and polished by hand;
And whipped-up foam that I think must be
What mermen use for cream in tea.

These and a million treaures I know
Strew the beach when the tide is low--
But very few people seem to care
For such gems scattered everywhere.
Lots of these jewels I hide away
In an old box I found one day.
And if a beggar asks me for bread
I will give him diamonds instead.

Note: It doesn't always have to rhyme!

"A Fishy Square Dance" by Eve Merriam

Tuna turn,
flounder round,
cuttlefish up,
halibut hold;

clam and salmon
trout about,
terrapin,
shrimp dip in;

forward swordfish,
mackerel back,
dace to the left,
ide to the right;

gallop scallop,
mussel perch,
grunnion run,
bass on down;

finnan haddie,
skate and fluke,
eel and sole,
shad and roe;

haddock, herring,
hake, squid, pike:
cod promenade
and lobster roll!

Activities:

II. Language Arts (Cont'd)

"At The Sea-Side" by Robert Louis Stevenson

When I was down beside the sea
A wooden spade they gave to me
To dig the sandy shore.

My holes were empty like a cup.
In every hole the sea came up,
Till it could come no more.

Don't You Turn Back - Poems by Langston Hughes

"Long Trip"

The sea is a wilderness of waves,
A desert of water.
We dip and dive,
Rise and roll,
Hide and are hidden
On the sea.
Day, night,
Night, day,
The sea is a desert of waves,
A wilderness of water.

"Sea Calm"

How still,
How strangely still
The water is today.
It is not good
For water
To be so still that way.

Haiku: The Mood of the Earth by Ann Atwood
Charles Scribner's Sons

Beautiful accompanying photographs!!!!

A blank page of sand--
at the water's cutting edge
the pattern shaping.

In a creature's shell
flashing in waves of sunlight
the waking of wings!

Activities:

II. Language Arts (Cont'd)

C. Poetry - Haiku:

Half mocking the sea
the gulls dip within reach of
each exploding wave.

Ebb tide at sundown...
Now clouds of foam no longer
blur the bright mirror.

On wood returning
from a long sea journey
the deepest print of waves.

Sea rocks blown with fog...
Time locked in mist
long long forgotten.

Cold lick of the sea...
The birds fleeing from it
the grass flowing with it.

Activities:

III. Math

A. Game "Going Beachcombing"
Adapt to meet your particular math needs.

B. Manipulative activities
Have a collection of 10-15 different sized shells.

1. Wrap string around widest part, then measure length of string.

2. Trace around each shell, then measure width or length.

3. Count the rings on the clam shells, compares numbers.

4. Graph number of bivalves and univalves.

5. If you have a simple scale, weigh the different sized shells.

Activities:

IV. Pantomime

If pantomime is new to your class, do some "warm up" exercises like:

-grow from a seed to a flower
-wave good-bye to your best friend
-wave good-bye to someone you dislike, but be polite
-melt slowly like an iceberg in the sun
-read a sad book
-look in a mirror (your partner mirrors your actions)
-climb a ladder

-open a
  package of seeds
  can of paint
  umbrella
  Chinese fortune cookie
  jar of glue
  letter
  bottle of catsup

-exerpts from Getting It Together With Books by Caroline Feller Bauer.
-there are more pantomime ideas in it and your school library has a copy.

Sea Week pantomime suggestions:

-You are a seagull swooping over the sea.
-You are a wave rolling onto the beach.
-You are a fish caught on the end of a fishing line.
-You are a crab scurrying across the sand.
-You are an eagle. (Read "The Eagle" by Alfred Tennyson first.)
-You are going wading in the ocean and a crab hooks onto your big toe.
-You are building a sand castle.

(This list is only a beginning, add your ideas to it).

Activities:

V. Audio-Visual

Have a filmstrip center, children view the filmstrip and then do a correlated activity.

Eg. A question sheet on contents of filmstrip.

Draw a picture of something learned from the filmstrip and label or write about it.

Make a list of 3 amazing things that were in the filmstrip.

After everyone has viewed the filmstrip, discuss it.

Activities:

VI. Art - Children should be encouraged to see the beauty of the shells as they are.

A. Wall mural using paints or crayons or both.

A mural using "mixed media", real shells on a painted seashore, real sand, etc. White glue will hold items securely.

B. Make mini-aquarium using meat tray or paper plate, creating sea life out of construction paper, then covering it with cellophane wrap.

C. Make an underwater scene using a crayon resist technique. Draw picture with crayons, then "wash" it with blue or or aqua watercolor or thin tempera paint.

D. Make a beach or sea diorama in a shoe box. Make crab, octopus and shell to put into the diorama. (Make a ditto and run off on appropriate colored paper).

E. Sketch shells and live creatures in a sea water habitat. Will aid in observation skills.

F. Activities using shells:

1. From The Beachcomber's Book by Bernice Kohn

a. Make a wind chime
b. Make shell flowers
c. Make shell animals
d. Make a shell mobile

2. From Snips and Snails and Walnut Whales by P. Fiarotta

a. Make a shell necklace and pin
b. Make a "Slowpoke Turtle"
c. Make a "Butterfly Mobile"
d. Make a picture frame
e. Make a collage box
f. Make a shell comb

G. Impressions of shells in clay

H. Beach mosaic, could use a piece of driftwood as a base.

Field Trip

I. Activities at the beach

A. Locate shells and other creatures in their actual habitat.

Make a booklet to take to the beach to serve as a check-list. (Pages you could possibly use are included.)

B. Make shell imprints in the wet sand.

C. Bring newsprint and crayons and do beach rubbings.

D. Have a scavenger hunt. Possible items to have on list:

1. 5 gum wrappers
2. pop can flip lids
3. bottle caps
4. a feather
5. shed bark
6. dandelion
7. black pebble
8. piece of foil
9. round pebble
10. empty cans
11. cellophane
12. string
13. wire
14. broken glass (be careful!)
15. white pebble
16. piece of newspaper
17. matchbook
18. quartz
19. cigarette package
20. small twig
21. clam shell
22. shell with barnacle
23. mussel
24. leaf
25. seaweed

E. Map Work

1. Make a simple map of the beach you are going to. After arriving have the students add features and write a legend to explain their additions.

OR

2. Make a map <u>after</u> you've arrived at the beach.

Field Trip (Cont'd)

II. Activities after your field trip

A. "Language experience" type story. Each child gives a sentence telling of his day at the beach and the teacher records it on chart paper.

B. Each child writes his own story about the field trip. He could illustrate it.

C. Go over booklets with students and see how successful the "searchers" were.

D. Do any of the Science activities again. The activities may be more meaningful after the beach experience.

TEACHER INFORMATION
FOR
SEA WEEK CURRICULUM MATERIALS

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2nd GRADE

Name of Sea Week Materials	Contents and/or Use
1. MOLLUSKS	
Worksheet # 1A - Mollusks	Reading
Worksheet # 1B - Mollusks	Vocabulary Building
Worksheet # 2 - Gastropod	Reading
Worksheet # 2A - Cephalopoda	Reading
Worksheet # 3 - Chiton	Reading, Coloring
Worksheet # 4 - Chiton	Reading, Coloring
Worksheet # 5 - Review	Matching
Worksheet # 6A - Mollusks - review, to accompany #6B	
Worksheet # 6B - Mollusks	Vocabulary Review,(Identify and Color).
2. UNIVALVES	
Worksheet # 1A - Univavles	Labeling
Worksheet # 1B - Univalve Vocabulary	Vocabulary Building
Worksheet # 2 - How Do Univalves Eat?	Reading
Worksheet # 3 - Moon Snail	Reading
Worksheet # 4 - Sand Collar	Reading
Worksheet # 5 - Whelks	Reading, Coloring
Worksheet # 6 - Hairy Triton	Reading, Coloring
Worksheet # 7 - Hairy Triton	Reading, Coloring
Worksheet # 8 - Limpets	Reading

Name of Sea Week Materials	Contents and/or Use
Worksheet # 9 - Limpets	Reading, Fill in Words
3. BIVALVES	
Worksheet # 1A - Bivalve	Vocabulary
Worksheet # 1B - Bivalve	Vocabulary
Worksheet # 2 - Clams	Reading
How do Clams Eat	Reading
Worksheet # 3 - Bivalves	Reading, Coloring
Worksheet # 4 - Bivalves	Diagram
Worksheet # 5A - Parts of a Bivalve	Reading
Worksheet # 5B - Parts of a Bivalve, to go with #5A.	Following Directions, Coloring
Worksheet # 6 - Blue Mussels	Reading
Worksheet # 7 - What Do Mussels Eat?	Reading, Comprehension
Worksheet # 8 - Scallops	Comprehension, Coloring
Worksheet # 9 - Scallops	Comprehension, Coloring
Worksheet # 10 - Cockles	Comprehension
Worksheet # 11 - How Does a Cockle Move Around?	Comprehension
Worksheet # 12 - Umbo	Comprehension
Worksheet # 13 - Bivalves	Word Picture Matching

STUDY PRINTS - 15x17½ = Full Color Drawings

1. Univalves	Oregon Triton	*
2. Chiton	Diagram	*
3. Bivalves	Clam Diagram	*

SLIDE/TAPE SHOW* — Mollusks of Alaska's Marine Waters
Slides, Cassette

*Available from the South East Regional Resource Center
538 Willoughby Avenue, Juneau, Alaska 99801

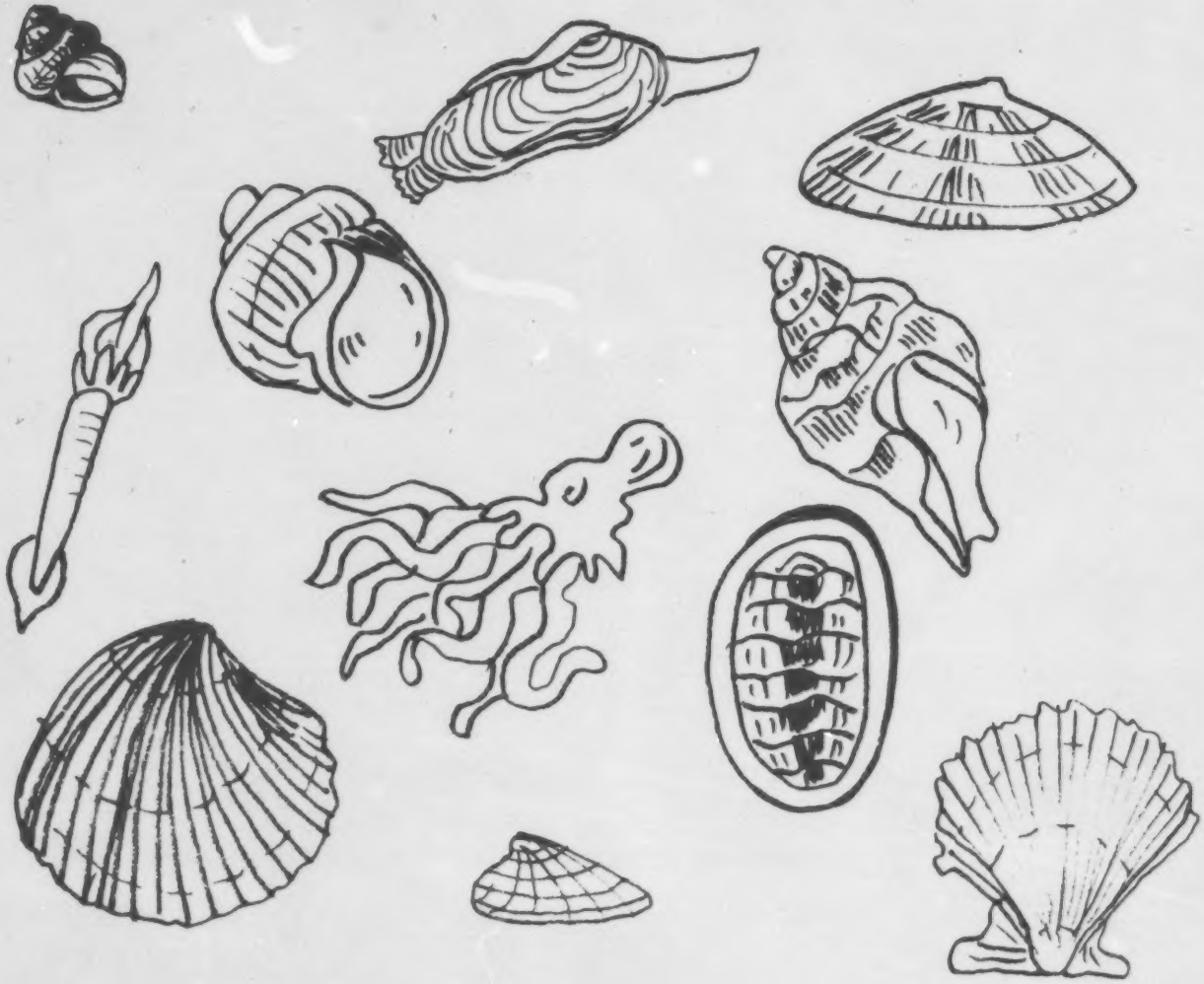
Name: _____

Mollusks

A mollusk is an animal that moves on a big foot.

Usually the body is protected by a hard shell.

These are mollusks.



Worksheet 1-B
Mollusks

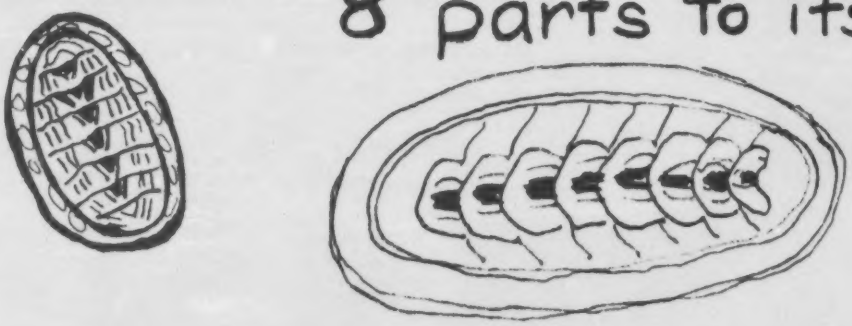
Name: _____

Mollusk (mollusca)
An animal with a soft body often protected by a hard shell.

Univalve - This mollusk has only one shell.

Bivalve - This mollusk has two shells.

Chiton - A mollusk with 8 parts to its shell.



Worksheet 2
Mollusks

Gastropoda

A type of mollusk that has a large foot.

They also have a head with tentacles, a pair of eyes and a mouth.

Name: _____

Worksheet 2-A
Mollusks

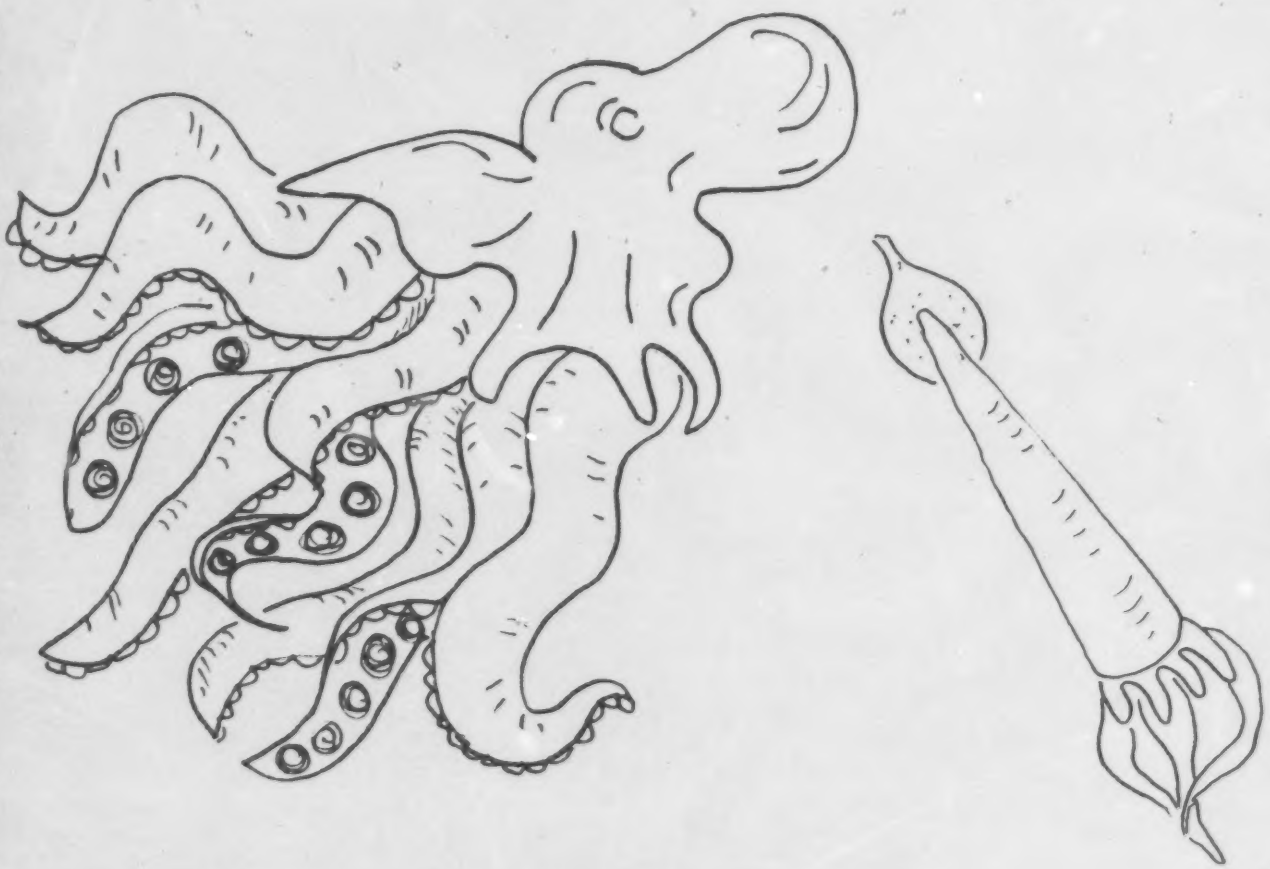
Name: _____

Cephalopoda

This group does not have a shell.

They have many tentacles.

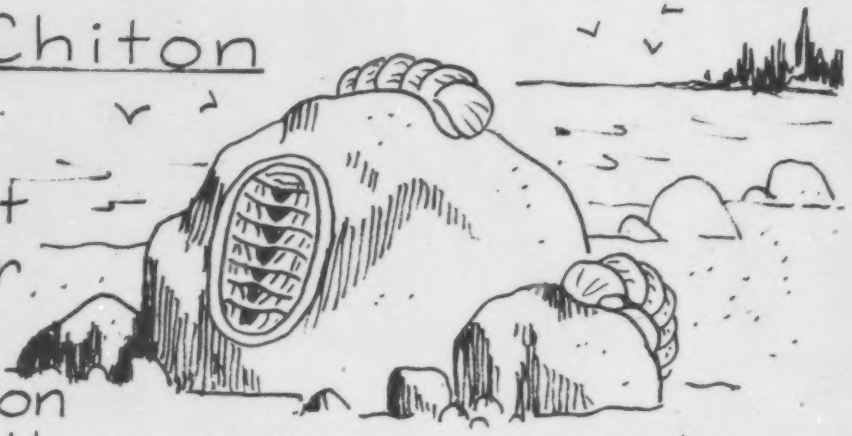
Octopus and squid are members of this family.



Worksheet 3
Mollusks

Name: _____

Chiton



A chiton is a mollusk that can curve over a rock.

It can hold on very tightly. Have you ever tried to pull one off a rock?

Lined Chiton

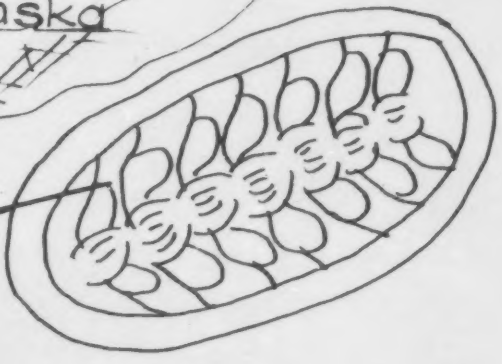
Give this lined chiton spots and stripes of many colors.

Color the gumboot dark red.

(lifesize)

Gumboot

One of the largest Chitons in Alaska, it has been used for a long time as food by the Southeast Alaska Indians.



Katy Chiton

Color the Katy chiton black with white valves.

Worksheet 4
Mollusks

Name: _____

Chitons

A chiton is a mollusk that can hold on tight to a rock.

A chiton has 8 parts to its shell.

Chitons can be many sizes and colors.

Color the lined chiton many colors.

Color this Gumboot brown

underside of chiton

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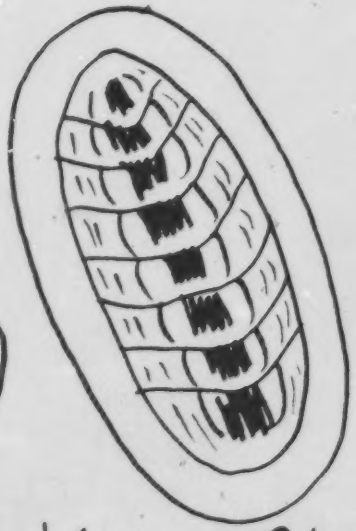
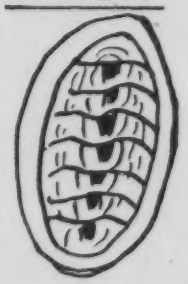


Katy Chiton

Lined Chiton



Color the Katy chiton black with white valves.

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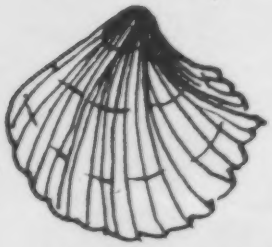
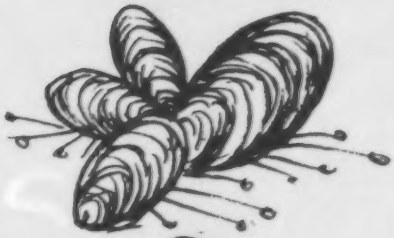
Worksheet 5
Mollusks

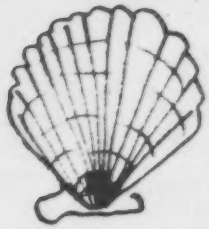
Name: _____

Review

Match the word with its picture.

1. mussels
2. clam
3. scallop
4. cockle
5. whelk
6. limpet



Worksheet 6-A
Mollusks

Name: _____

Review - Mollusks

Follow the directions:

1. Color the univalves pink.

2. Color the bivalves green.

3. Color the chitons brown.

4. Put a black X on the mollusks.

5. Put a blue ring around the gastropods.

6. Put a green circle around the cephalopods.

6-B

Vocabulary Review

Mollusks

Name: _____

Name _____

Univalve

A univalve is a mollusk. It has one part to its shell.

Draw a line from the word to the right part.

operculum

eye

spire

tentacle

aperture

Univalve Vocabulary

Valve - Means the same as shell.

Univalve - A mollusk that has one part to its shell.

Aperture - The opening in the univalve shell.

Operculum - The hard round plate that seals the shell opening of the univalve.

Spire - The top of the univalve shell.

Name: _____

How Do Univalves Eat?

Some univalves have a long tongue.

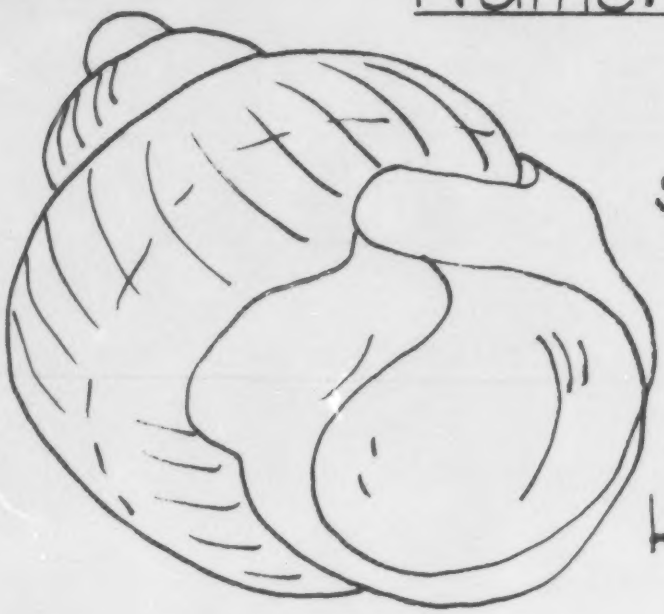
This tongue has many hooks.

It is used to drill holes into other animals.

It is sometimes used to scrape up microscopic plants from rocks.

Worksheet 3
Univalves

Name: _____



A moon snail is a univalve.

Do you know why?

Moon Snail

(Natica clausa)

A moon snail has a hard door. This door is called an operculum.

The operculum is pulled into the shell opening.

The operculum shuts the moon snail in its shell.

WORKSHEET 4
UNIVALVES

Sand Collar or Egg Case

A moon snail lays its eggs in a sand collar.

If you are lucky, you might find a sand collar on the beach.

Leave the sand collar on the beach. Then the eggs will hatch.

Name: _____

Whelks

(Thais lamellosa)

This whelk is a snail. This snail has only a long scientific name,

Thais lamellosa.

(Thā-is lam-ēl-ō-sa)

Can you say this name?

Thais lamellosa live on beaches in Alaska.

Each one looks a little different.

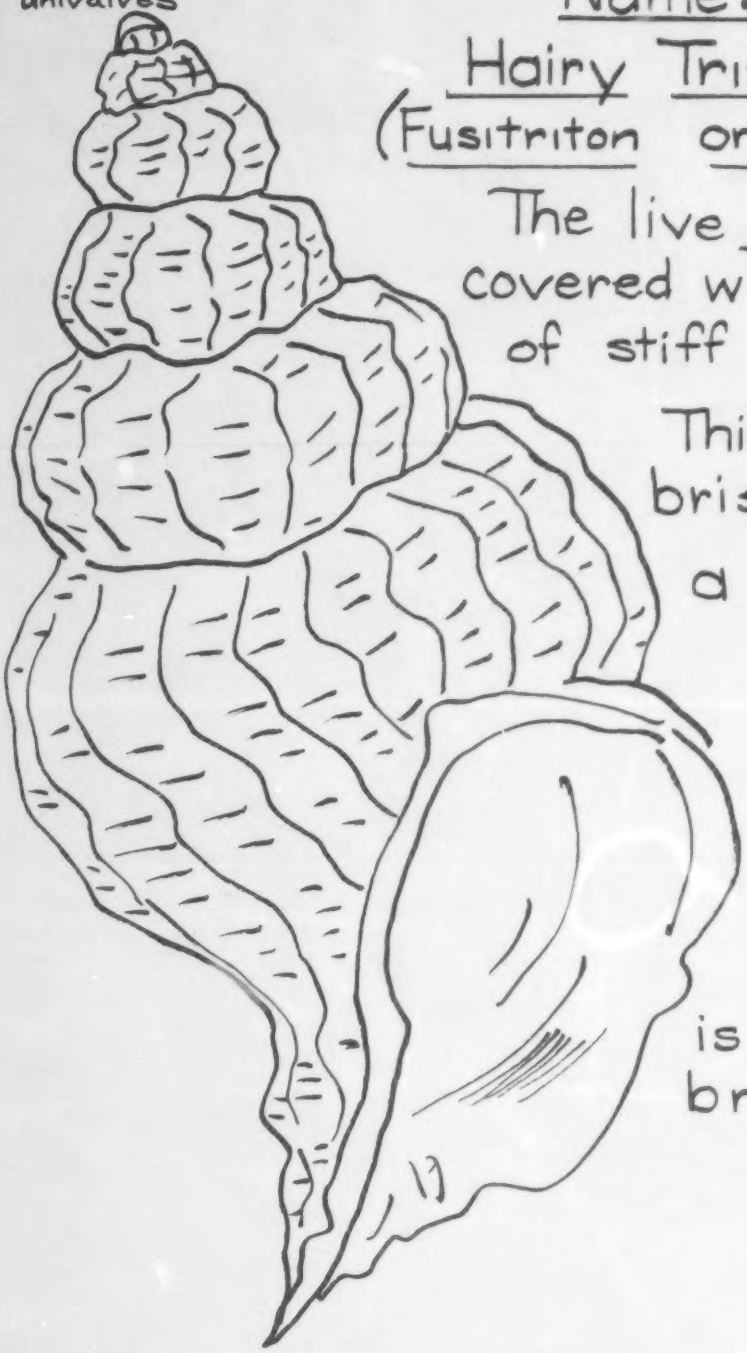
They may be all one color. Sometimes they may have bands of color. The color may be white or purple or yellow.

Color the Thais lamellosa on this page to look the ones on the beach.

Worksheet 6
Univalves

Name: _____

Hairy Triton
(Fusitriton oregonensis)



The live hairy triton is covered with a dark layer of stiff bristles.

This layer of stiff bristles is called a periostracum.

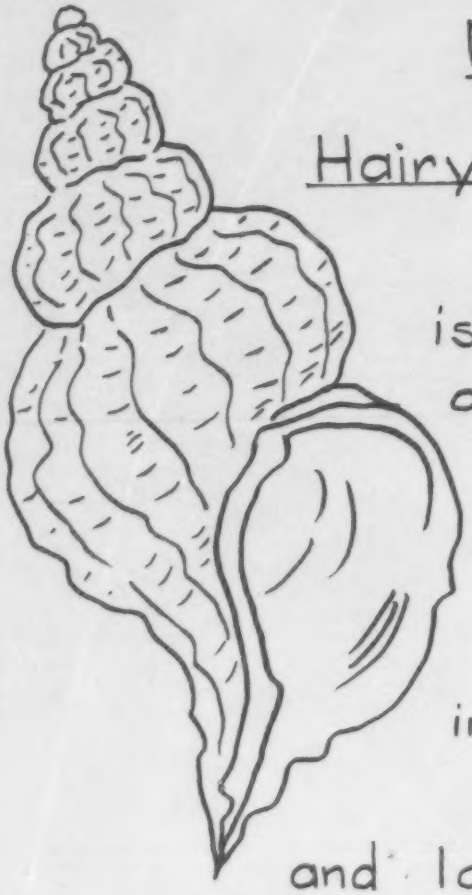
The shell under this periostracum is pink.

This pink shell is very easy to break.

Color this periostracum brown.

Color the shell without the periostracum pink.

Name: _____



Hairy Triton

The triton's operculum is large and looks like a fingernail.

Color the operculum brown.

The triton lays eggs in egg cases on rocks.

The cases are yellow and look like corn.

Color the egg cases yellow.

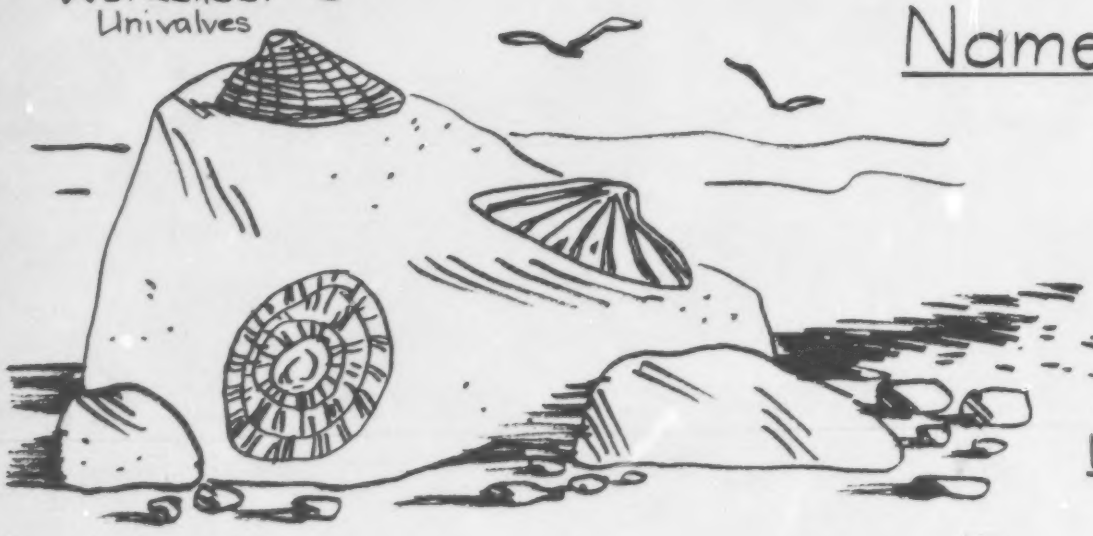
operculum

Triton Egg Cases

fingernail

Worksheet 8
Univalves

Name: _____



Limpets

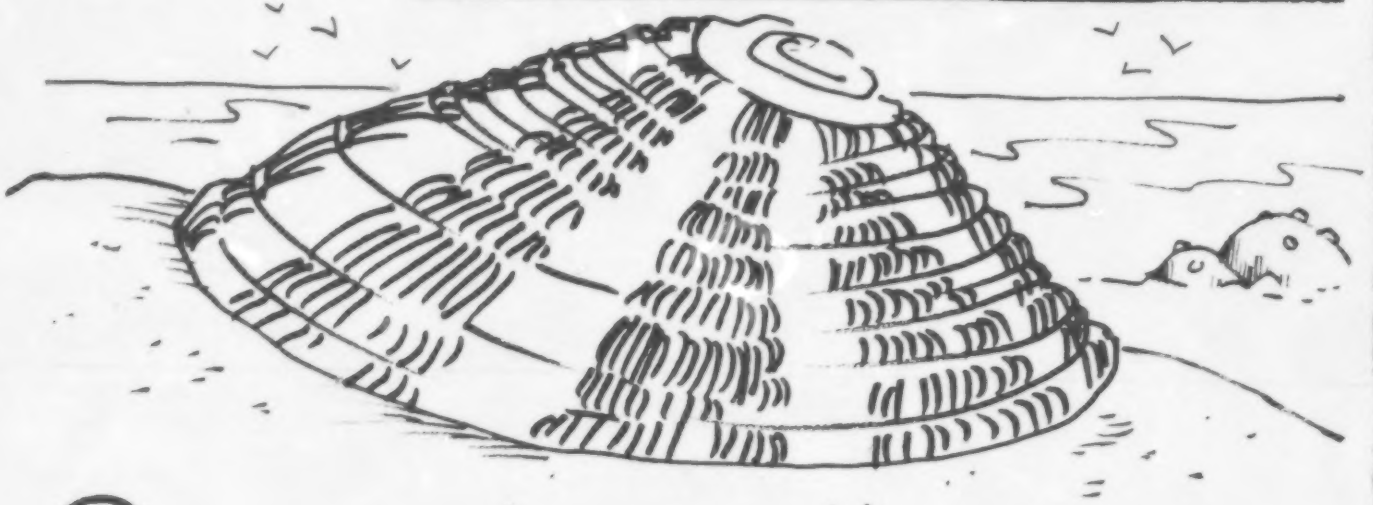
A limpet is a special kind of univalve.

Limpets look like pointed caps.

They live on rocks or other hard objects. They eat algae or seaweeds. They scrape the seaweeds off rocks with the ribbon-like radula covered with hooks.

WORKSHEET 9
Univolves

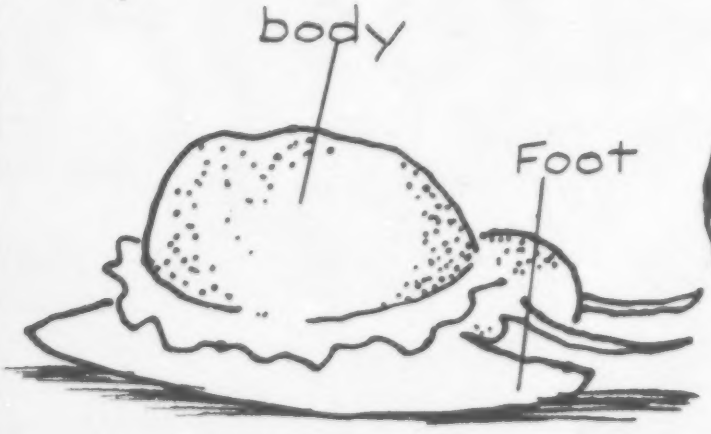
Name: _____



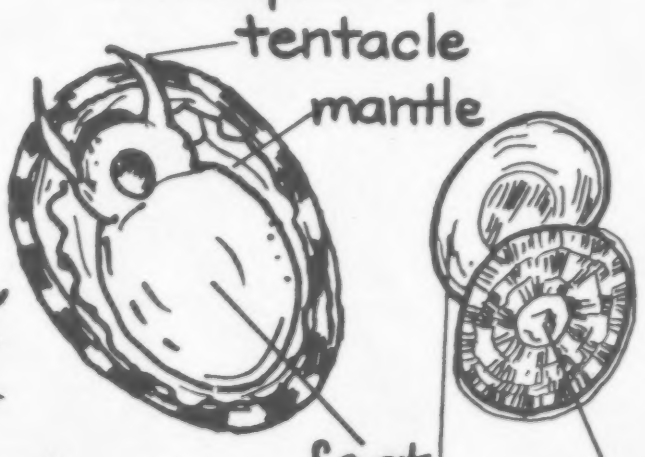
Do you know the name of this univalve?
The name of this univalve is a _____.

chiton limpet

Here are some other pictures of limpets.



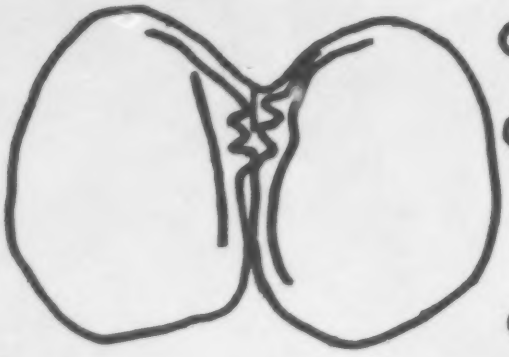
A limpet without a shell.



Bivalve Vocabulary

Valve - means the same as a shell.

Hinge Teeth - They stick out from both sides of the bivalve shells. They fit together and hold the two shells together.



Hinge Ligament - This ligament helps the hinge teeth hold the two bivalve shells together.

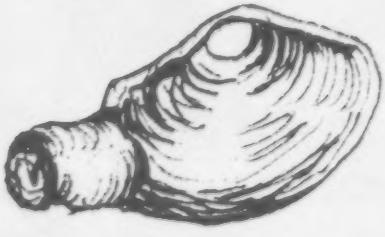
Adductor Muscle - This muscle opens and closes the shells.

Bivalve Vocabulary

Byssus – These look like threads. They connect a bivalve to rocks. They can connect bivalves to other things, too.

Siphon – A soft tube that the bivalve uses to take in and let out water.

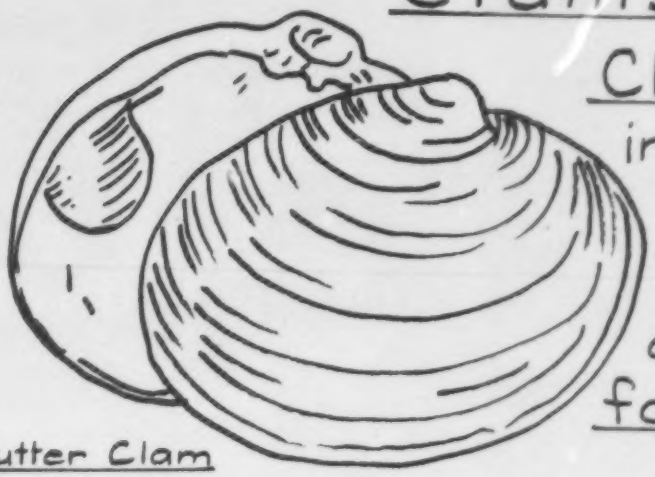
Neck – A part of the bivalve that sticks out. It has the siphons in it.



Worksheet 2
Bivalve

Name: _____

Clams



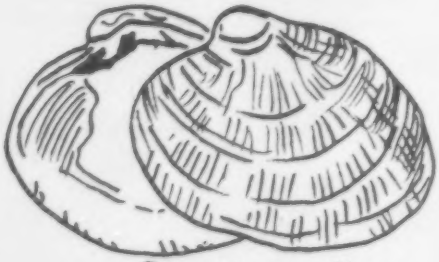
Butter Clam

Clams live in the sand or mud. They can dig deep with a strong foot.

How Do Clams Eat?

Clams use a long siphon that is like two straws to get their food.

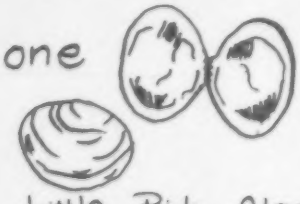
Tiny plants and animals that live in the water are a clam's food.



Steamer Clam

Water carrying these plants and animals is sucked in one part of the siphon.

Bent Nose Clam



Little Pink Clam

Then the clams eat the plants and animals and push the water out the other part of the siphon.

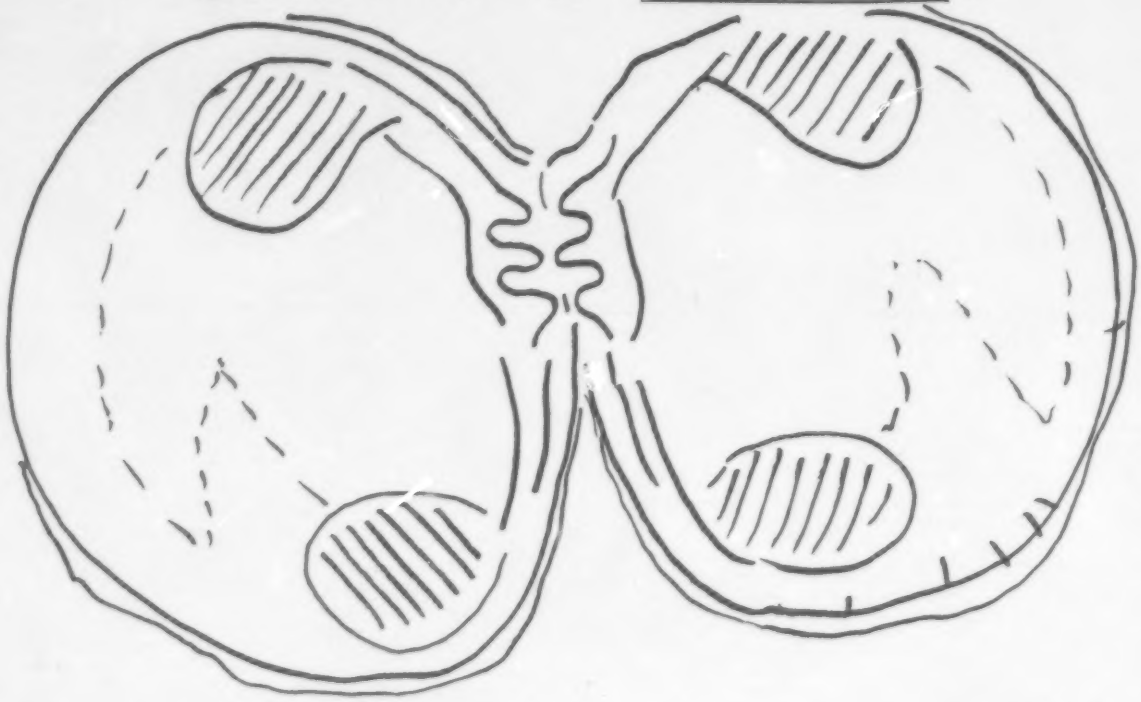
Name _____

Bivalves

A bivalve is an animal that lives in a shell.

The shell has two parts. The parts are called valves.

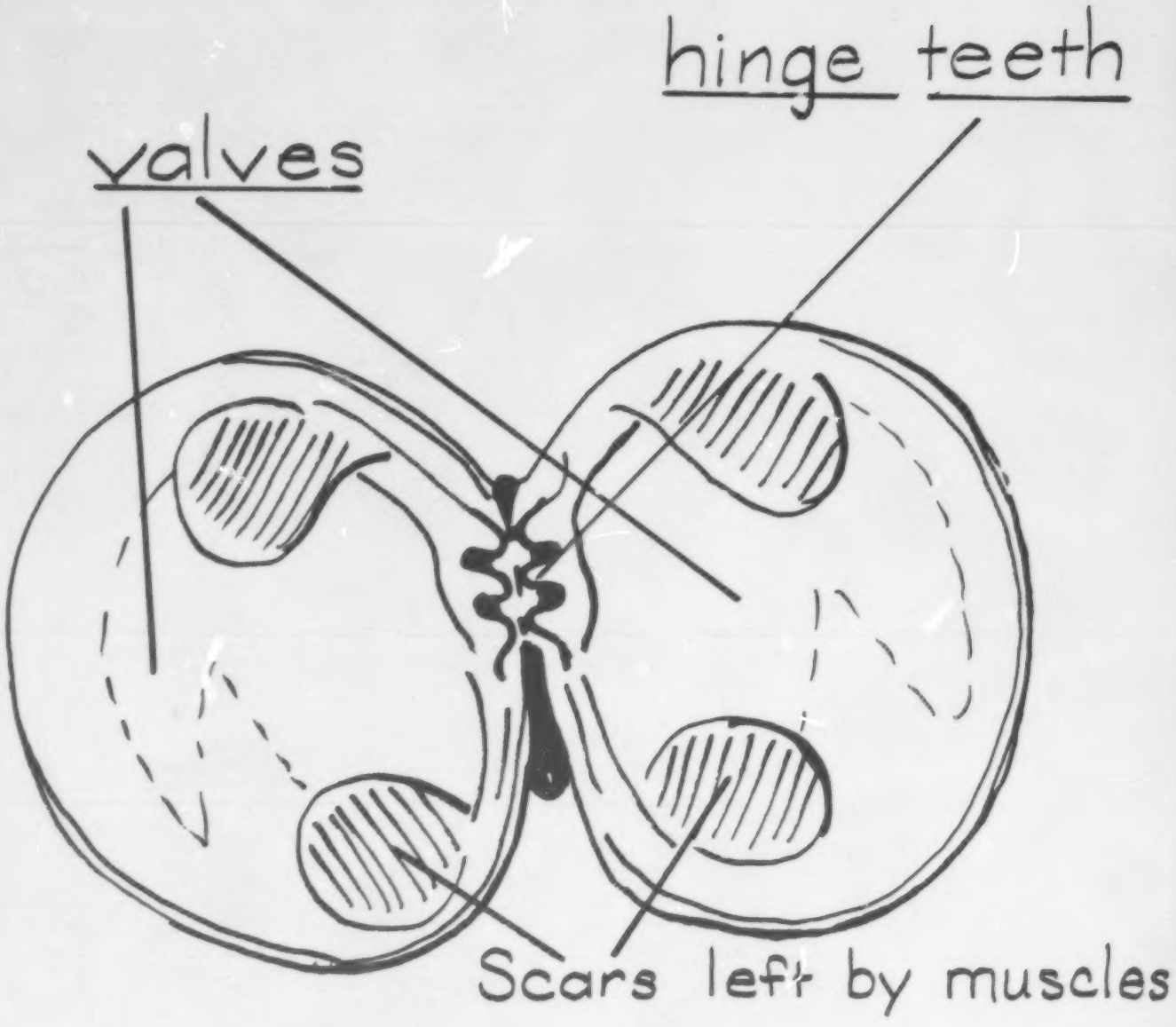
A clam is a bivalve.

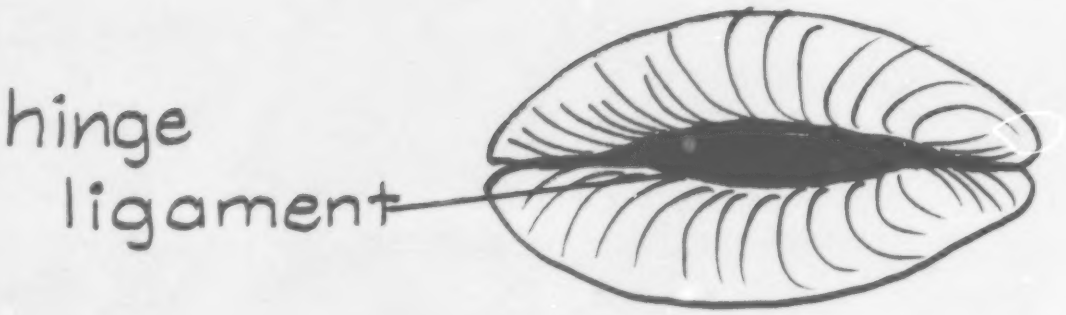


Color the muscle scars blue.
Color the hinge teeth yellow.
Color the rest of the shell brown.

Worksheet 4
Bivalves

Bivalves



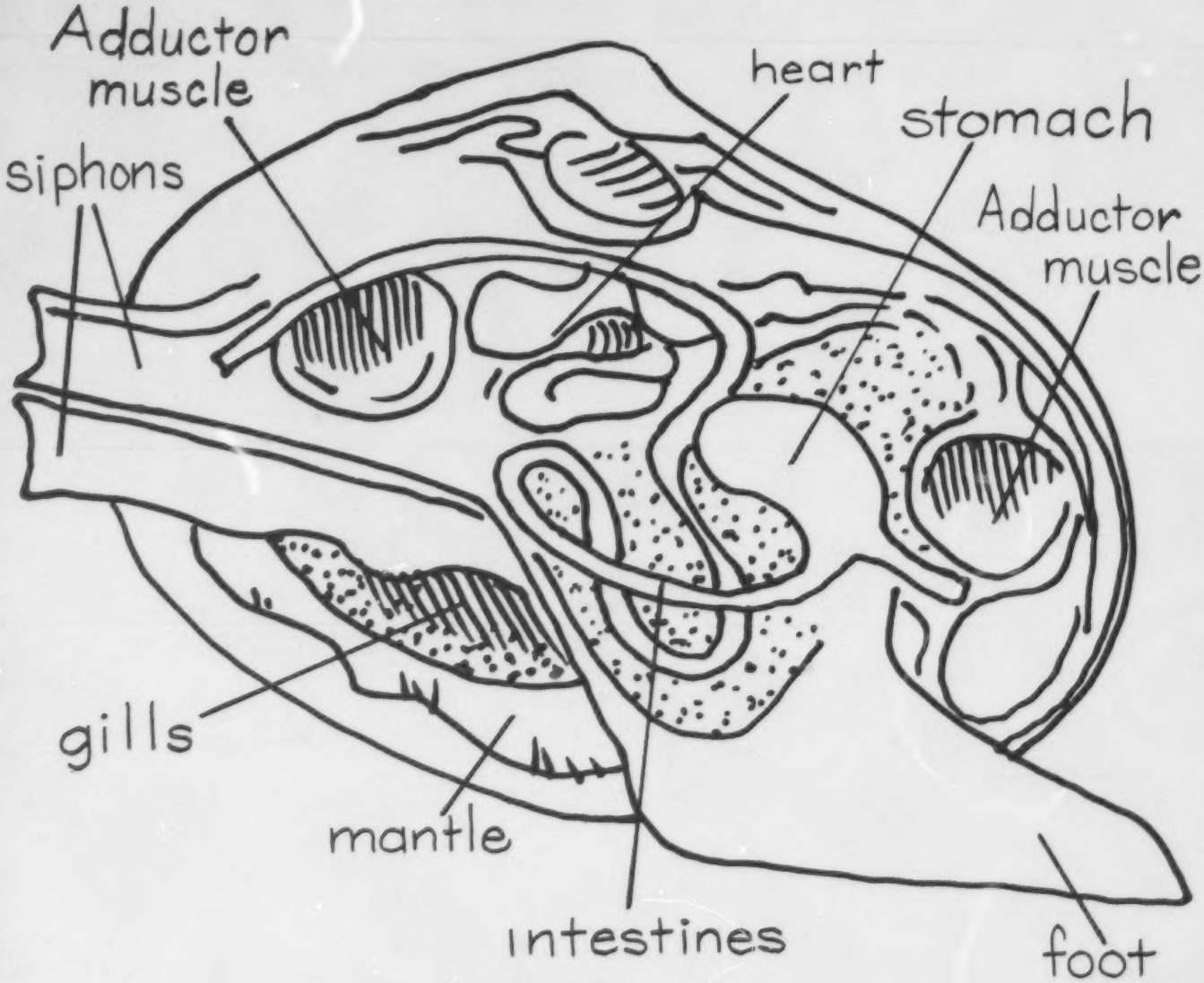


WORKSHEET 5-A
Bivalves

Name: _____

Parts of a Bivalve

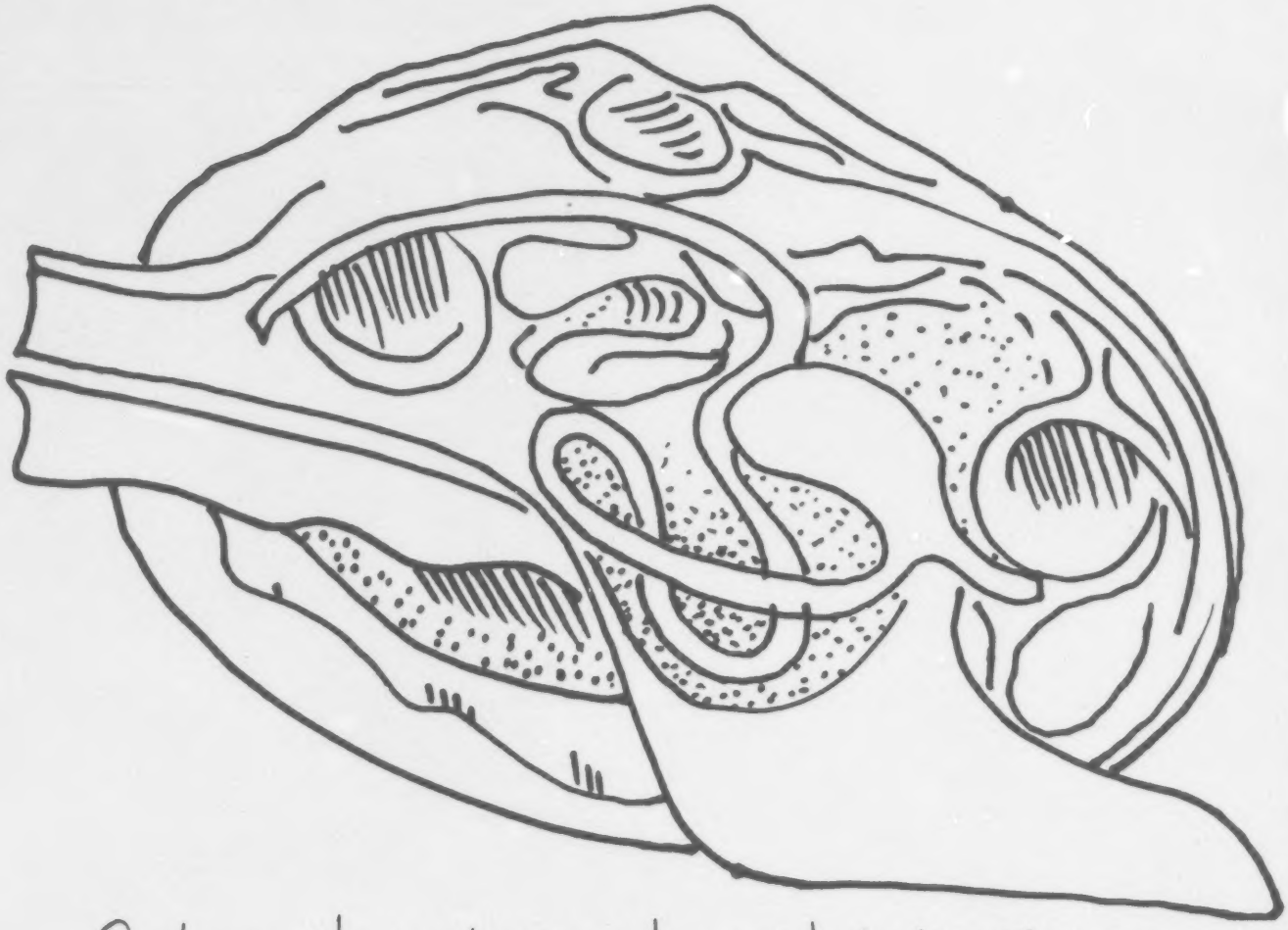
Most bivalves have a soft body inside a hard shell.



Bivalves have no head !

WORKSHEET 5-B
Bivalves

Name:



Color the stomach and intestines blue.

Color the heart red.

Color the siphons green.

Color the foot and mantle yellow.

Put a black X on the adductor muscles.

Color the gills orange.

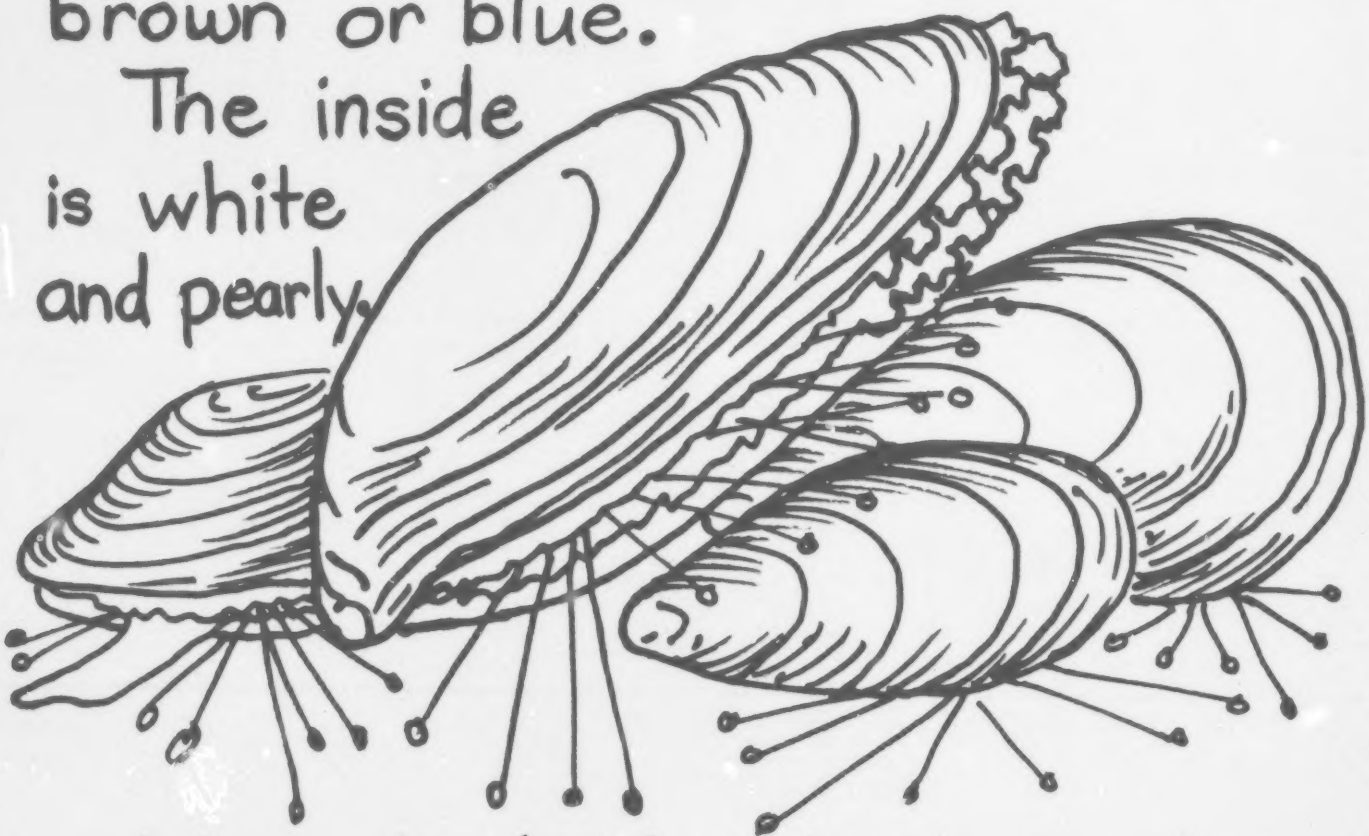
WORKSHEET 6
BIVALVES

Name: _____

Blue Mussels

(mytilus edulis)

Blue mussels live on the beach. They are bivalves. The outside of their shells is brown or blue. The inside is white and pearly.

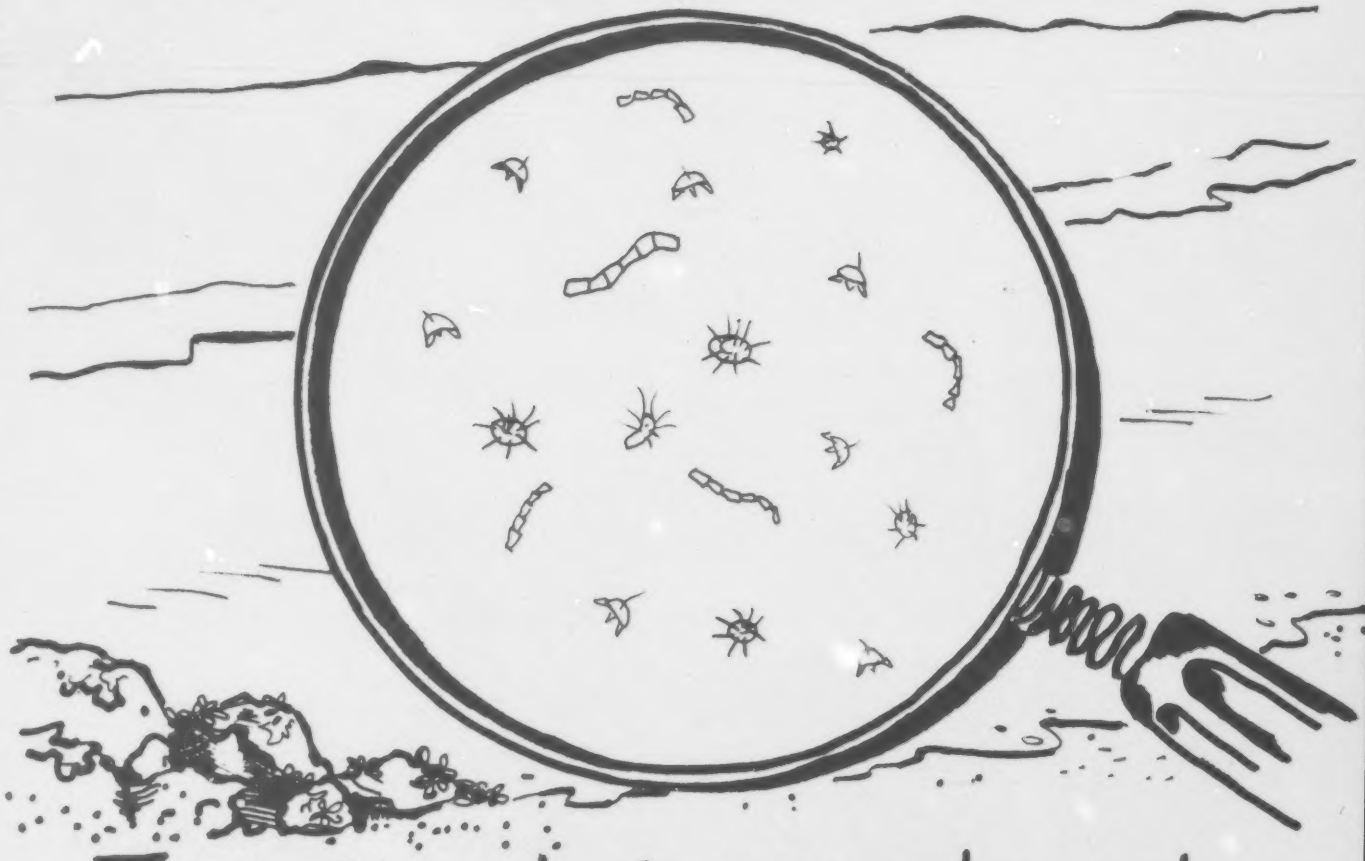


Mussels hold tight to rocks with small threads called byssus. Color each byssus.

WORKSHEET 7
BIVALVES

Name: _____

What Do Mussels Eat?

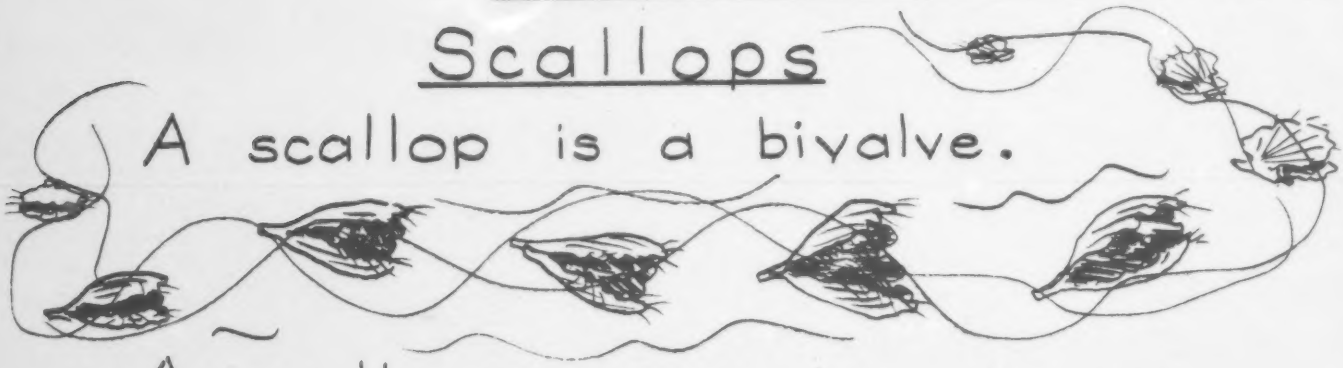


This is what mussels eat. Mussels use their siphons to strain these tiny microscopic plants and animals from the water.

Name: _____

Scallops

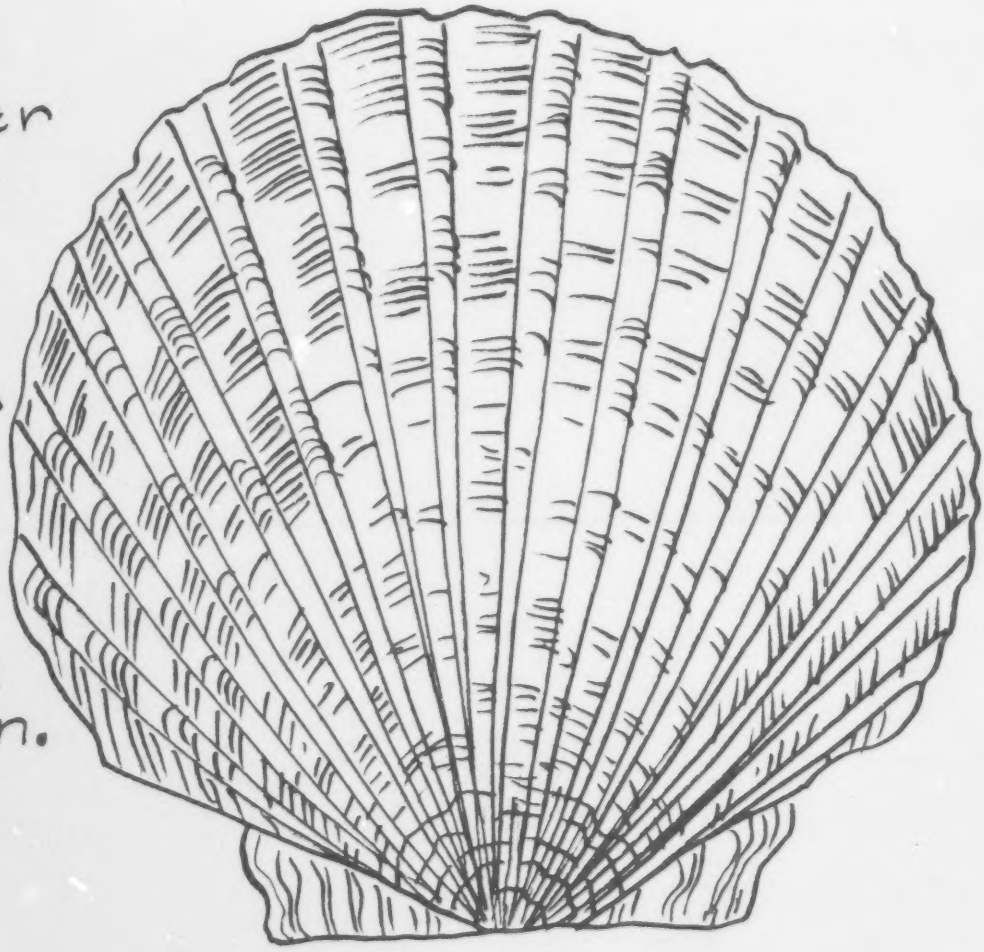
A scallop is a bivalve.



A scallop swims by clapping its two valves together.

A scallop can be big!

Even bigger than this!



Color this scallop brown.

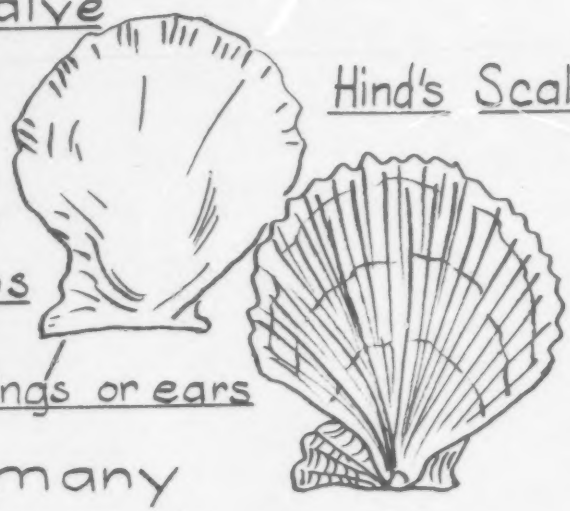
WORKSHEET 9
BIVALVE

Name: _____

Scallops

This beautiful bivalve is often used in art and designs.

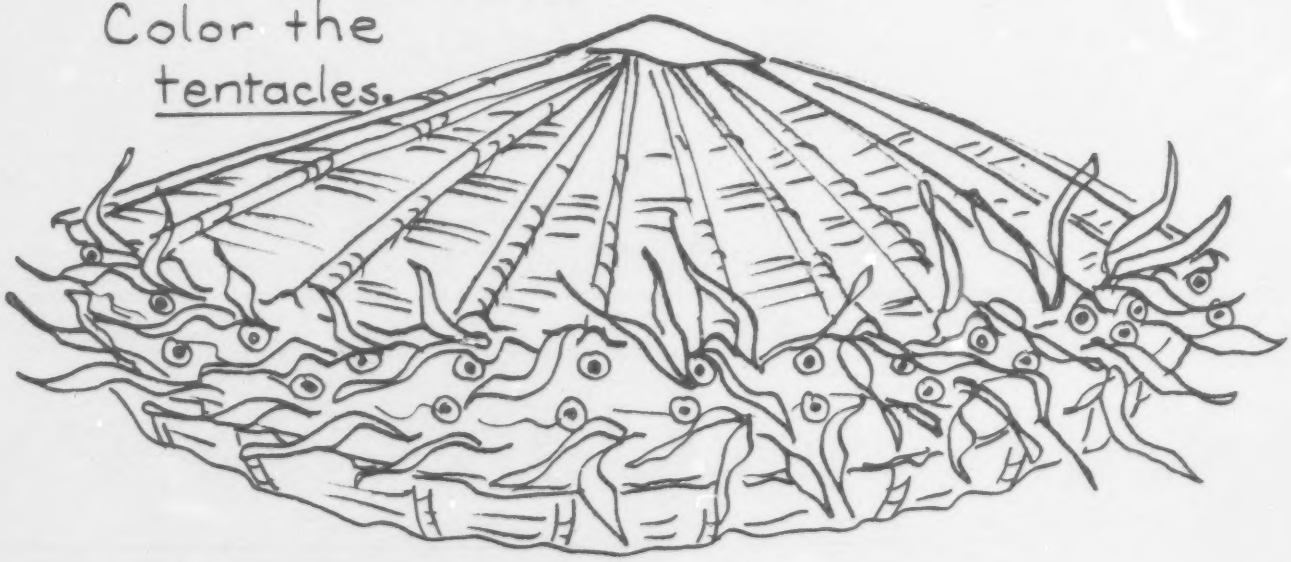
There are four or five kinds of scallops in Alaska.



A scallop has many tiny blue eyes. ⊙ ⊙ ⊙

A scallop has tentacles.

Color the eyes blue.
Color the tentacles.



Name: _____

Cockles

(Clinicardium Nutallii)

This is a heart cockle. Can you see why it is called a heart cockle?

This common Alaskan cockle lives on or in the sand.

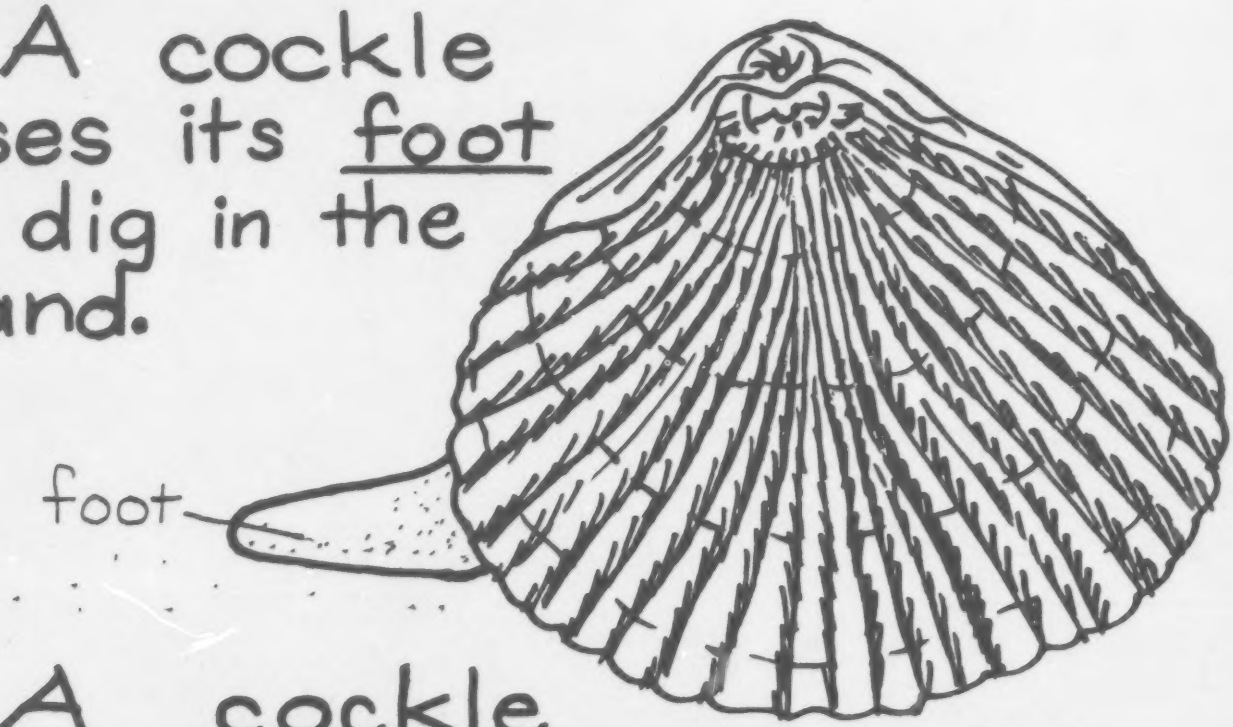
It can dig its way into the sand with its big, strong foot.

Here is a cockle with its foot out.

Name: _____

How does a Cockle move around?

A cockle uses its foot to dig in the sand.



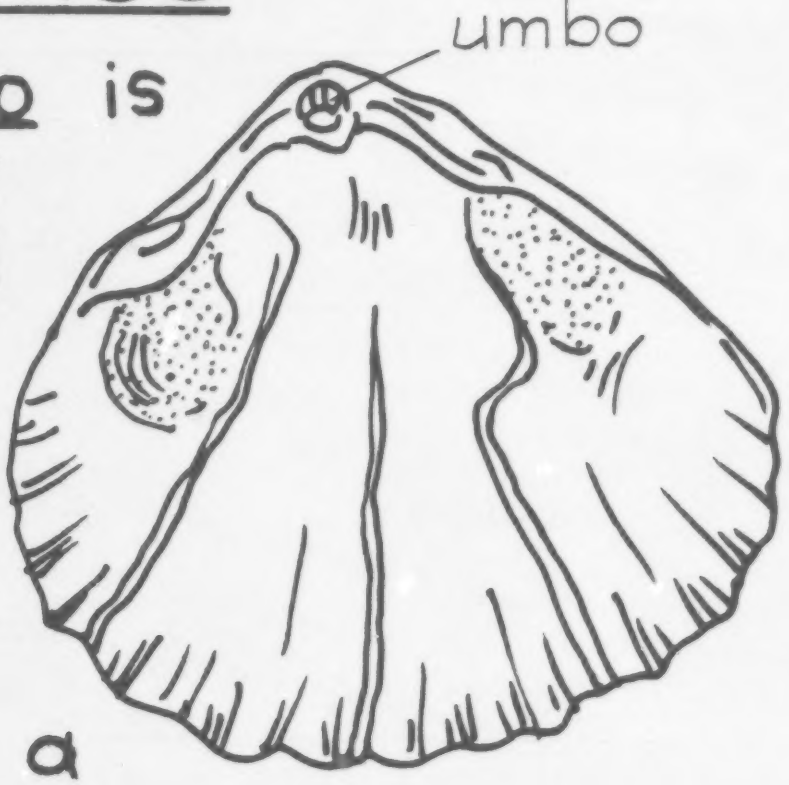
A cockle can use its foot to help it get away from starfish.

Some starfish like to eat cockles.

Name: _____

Umbo

The <u>umbo</u> is the oldest part of a shell.



Growth lines are very easy to see on a <u>cockle</u>.

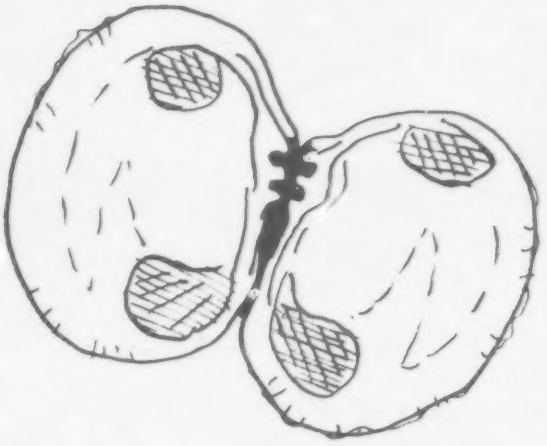
When you look at an umbo, you will see what looks like little <u>cockle</u>.

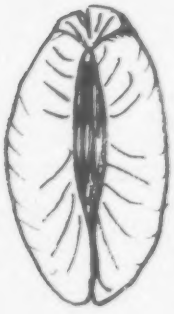
Name: _____

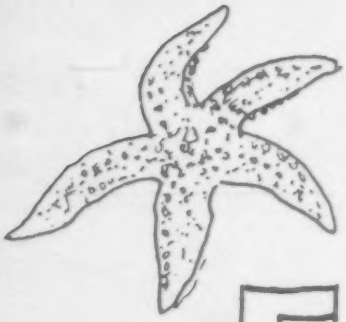
Bivalves

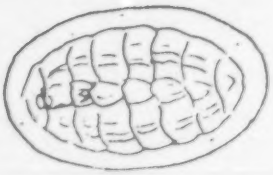
Make a line from the word to it's picture.

1. valve
2. hinge teeth
3. hinge ligament
4. adductor muscle
5. siphon
6. neck
7. foot

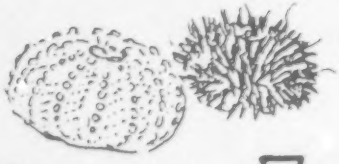


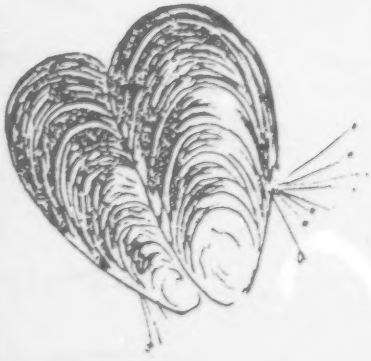






Exploring Intertidal Sea Life



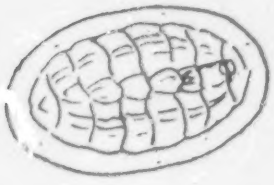


Check the box beside the animals you have seen.

Name _____

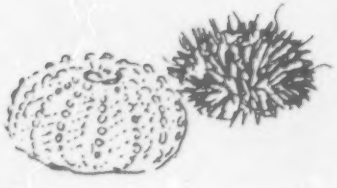
clam shell ☐

live clam ☐

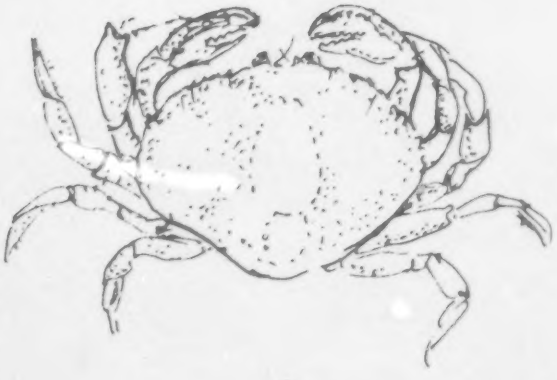


chiton ☐

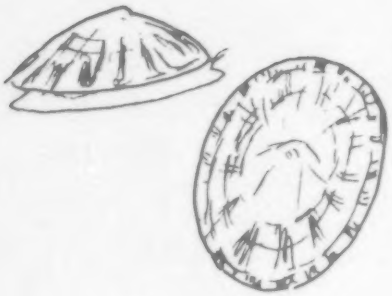
sea cucumber ☐



sea urchin ☐



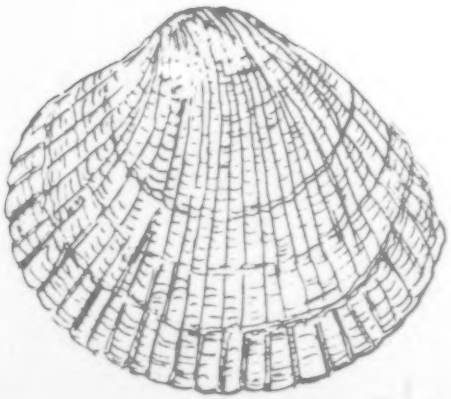
crab ☐



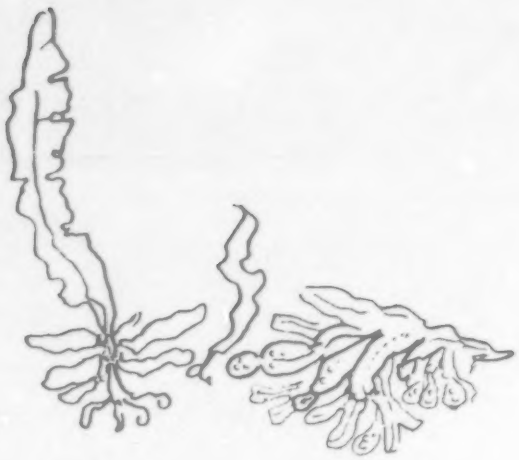
limpet ☐

whelk ☐

barnacles ☐

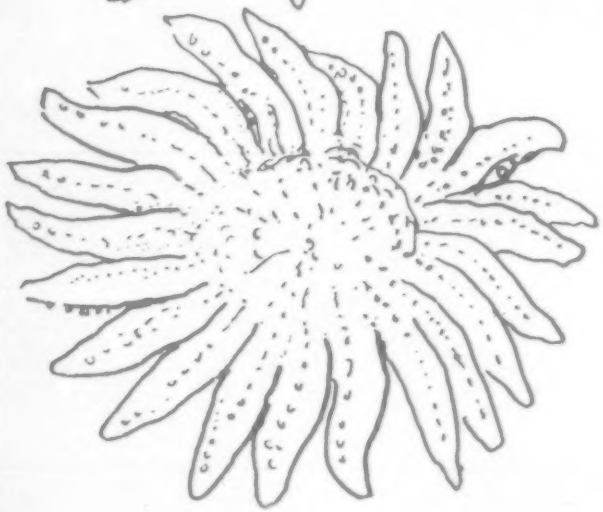


cockle ☐



seaweed ☐

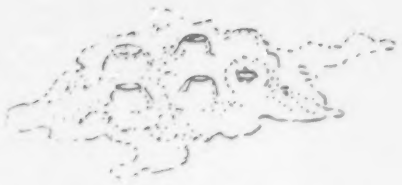
starfish ☐



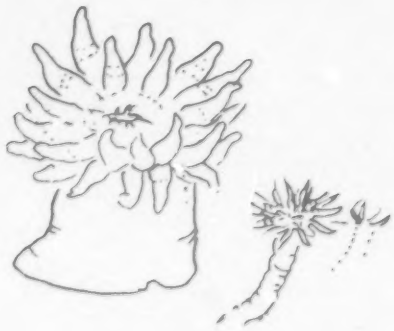
sunflower starfish ☐

6 rayed starfish ☐

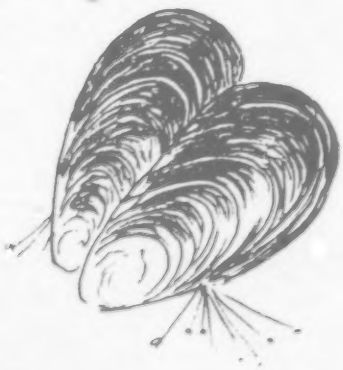
brittle star ☐



sponge ☐



sea anemone ☐



mussel ☐

Name_____ Date_____

WHO AM I?

I dwell in a shell,
But I'm not a clam.
My name sounds like I'm strong.
Can you guess who I am?

Clues: I live on rocks.
I am a bivalve.
I am blue and black.
My name starts with "M".

I am a _____.

Draw me:

BULLETIN IDEAS
for
ALASKA MARINE SHELLS

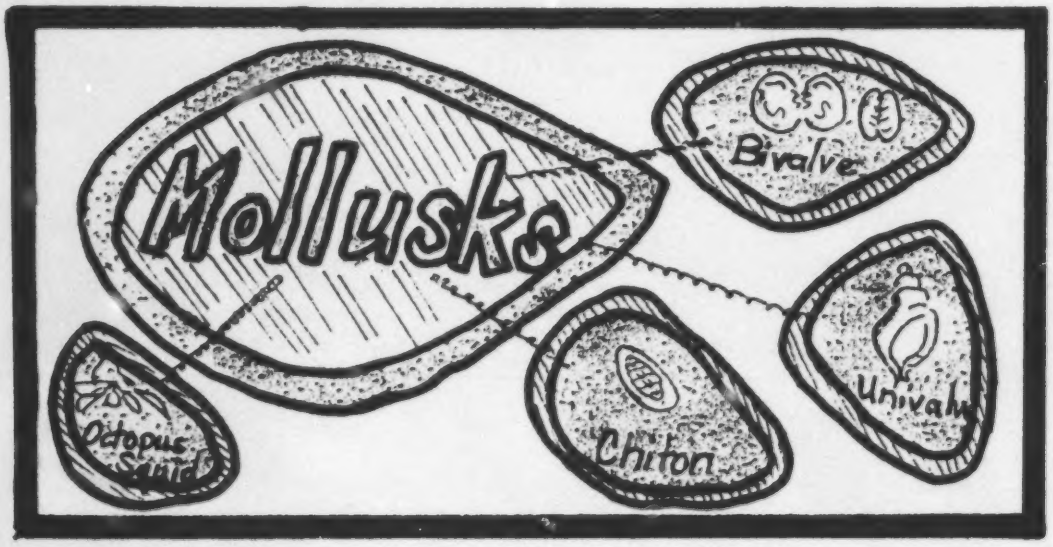
MOLLUSKS

(Phylum Mollusca)

The following are suggestions and ideas for bulletin boards based upon the information contained in the teacher's manual for Alaska Marine Shells, the Second Grade Level for Sea Week.

BULLETIN BOARD IDEA NUMBER ONE

I. Mollusks



1. Cut a large, bright colored piece of construction paper for the background area under the large word, MOLLUSKS. Cut a slightly smaller shape of a contrasting color. (About 2 - 4 inches smaller depending upon the size of your board.)

2. Using a contrasting color, cut out four shapes similar to the small shapes in the above bulletin board design. Cut a slightly larger shape of the same design as the contrasting color shape. (2-4 inches larger, but not quite the same as in #1)

****Suggested color combinations might be:

a. Red Covering all over Bulletin Board with Dark Red main color and light blue contrasting color.

b. White covering all over B. Board with bright yellow main color and black contrasting color.

c. Purple covering all over B.Board with light blue main color and and yellow contrasting color.

3. Have the children draw or collect actual samples of or find photographs of the following groups of shells. Place one or more from each group on separate irregular shapes. (See diagram on the previous page.)

BIVALVE: (Clams)

UNIVALVE: (Limpets, Snails, etc.)

CHITON

OCTOPUS AND SQUID

4. Attach colored pieces of yard, string, or strips of paper between the words as shown in the diagram on the previous page.

*****PATTERNS ARE INCLUDED ON THE FOLLOWING PAGES FOR YOUR CONVENIENCE.

We strongly suggest that you have the children in your class do of much of this bulletin board as they possible can.

Children are able to:

Use marking pens and make legible labeling for Bulletin Boards. (Remember to have them draw a life-size pencil sketch - so that you have the option of deciding whether they should continue or not. Probably difficult for Kindergarten and early first grade.)

Use marking pens to trace around teacher-made letters.

Cut out teacher-drawn bulletin board basic shapes.

Staple the background colors for the Bulletin Board.

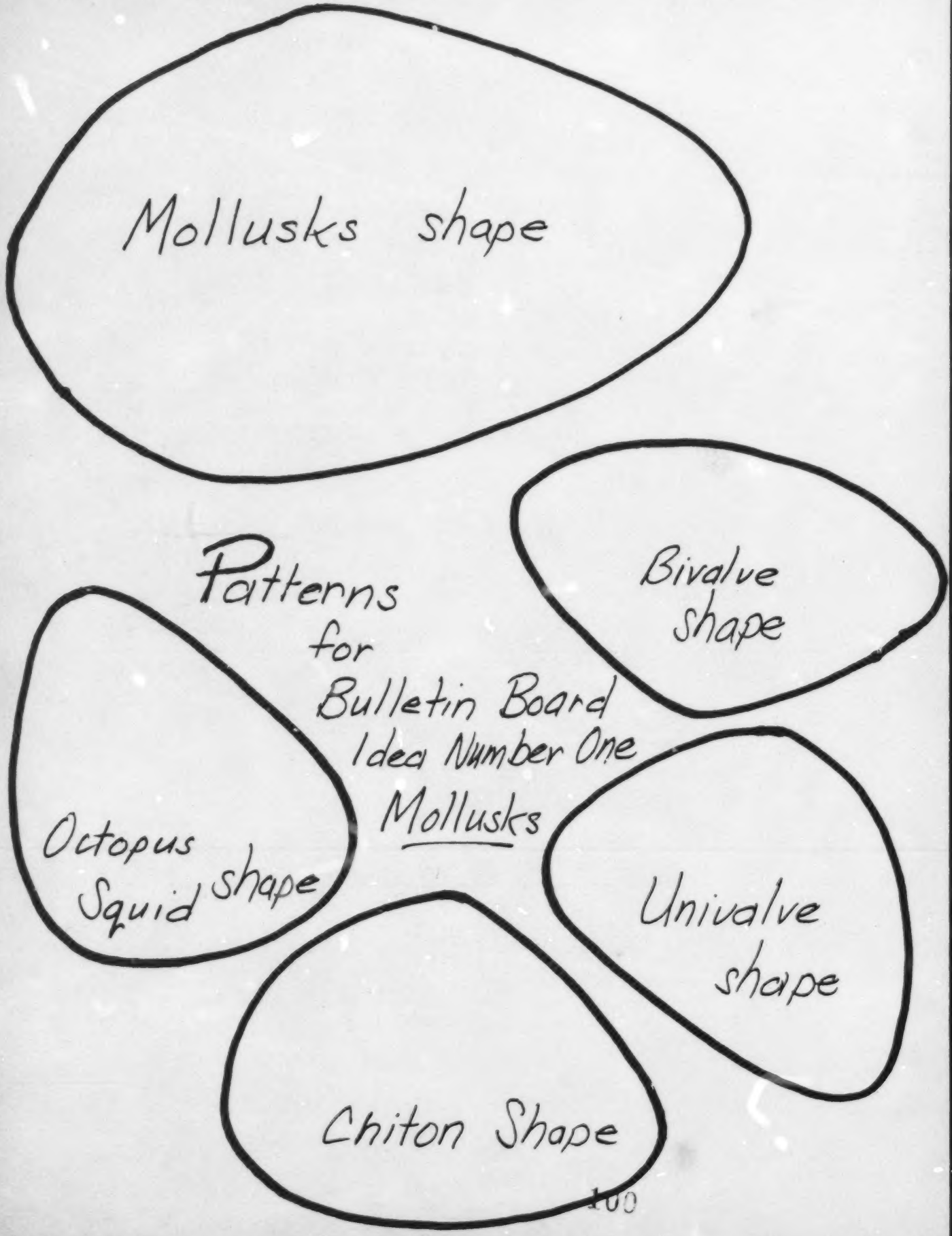
Attach the colored string, etc between the two shapes on the Board.

Decide which labels, letters, sample animals or drawings go where.

Decide, with the help of a teacher-directed class discussion, what colors to make the bulletin board.

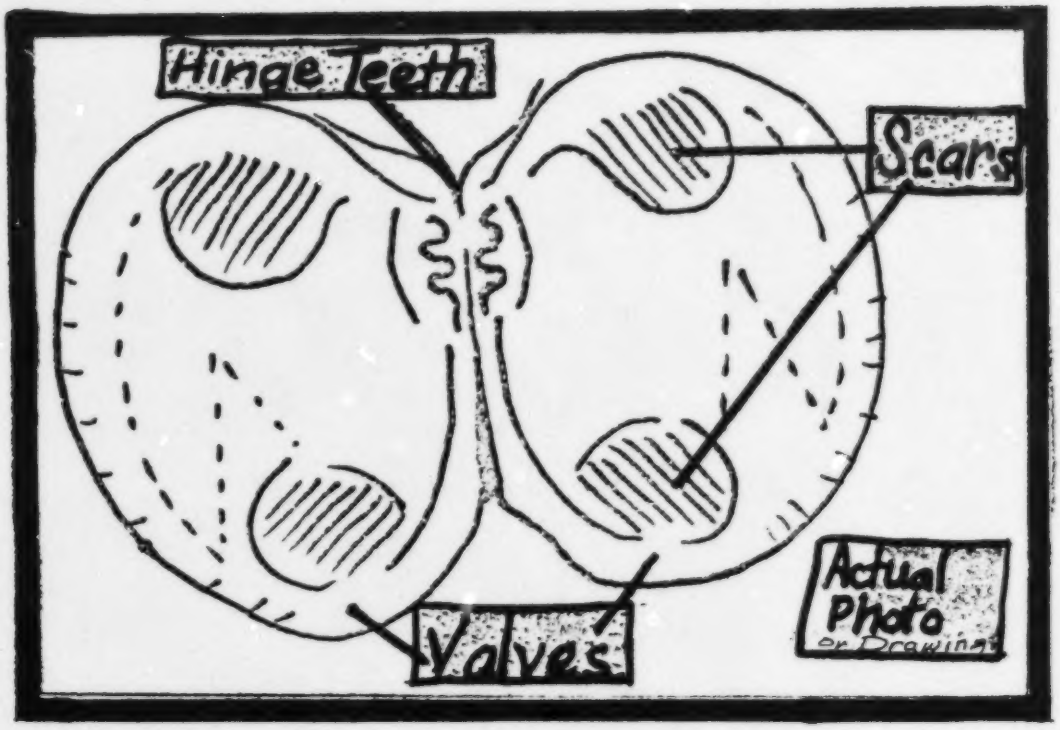
Make the bulletin board into a living, changing activity by the teacher encouraging the children to keep bringing in new materials for the bulletin board.

Make the Bulletin Board into a center of activity by discussion of the various shells that the children bring in from outside the school.


Mollusks shape
Patterns for Bulletin Board Idea Number One
Mollusks
Bivalve shape
Octopus Squid shape
Univalve shape
Chiton Shape

Patterns—Mollusks

II. BIVALVES



I. Make a large drawing of a bivalve and cut it out.

(Enlarge the pattern included with this section. Note, also, the section entitled "How to Enlarge a Drawing".)

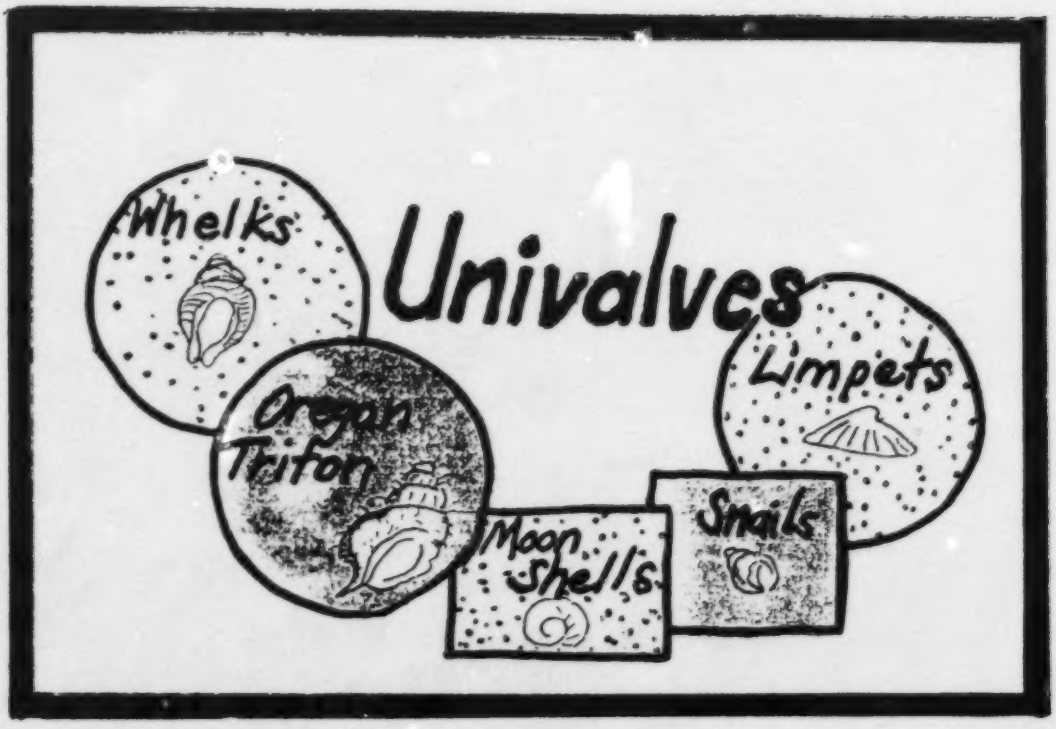
2. Make identification labels on colored paper.

3. Make letters to pin on identification labels. (See enclosed letters or use pre-made letters or have a talented student hand letter the labels.)

For variety you might make the letters raised. See the illustration below as to how to make raised letters.

4. Attach yarn with staples or colored paper or string between the labels and the parts of a bivalve.

III. UNIVALVES



1. Out of colored construction paper, cut three circles of the same size.

   *Have students trace around a plate or similar object. If paper plates are available, use colored ones.

2. Out of colored construction paper, cut two rectangles of the same size.

   *Or use pre-cut construction paper.

3. Out of construction paper, cut large letters that spell, UNIVALVES.

   *See section on "How to Make Letters". See below, how to make raised letters.

4. Have the students draw or find pictures or real shells of:

   Whelks
   Oregon Triton
   Moon Shells
   Snails
   Limpets

5. Label each shell in #4 with pre-made or hand lettered letters.

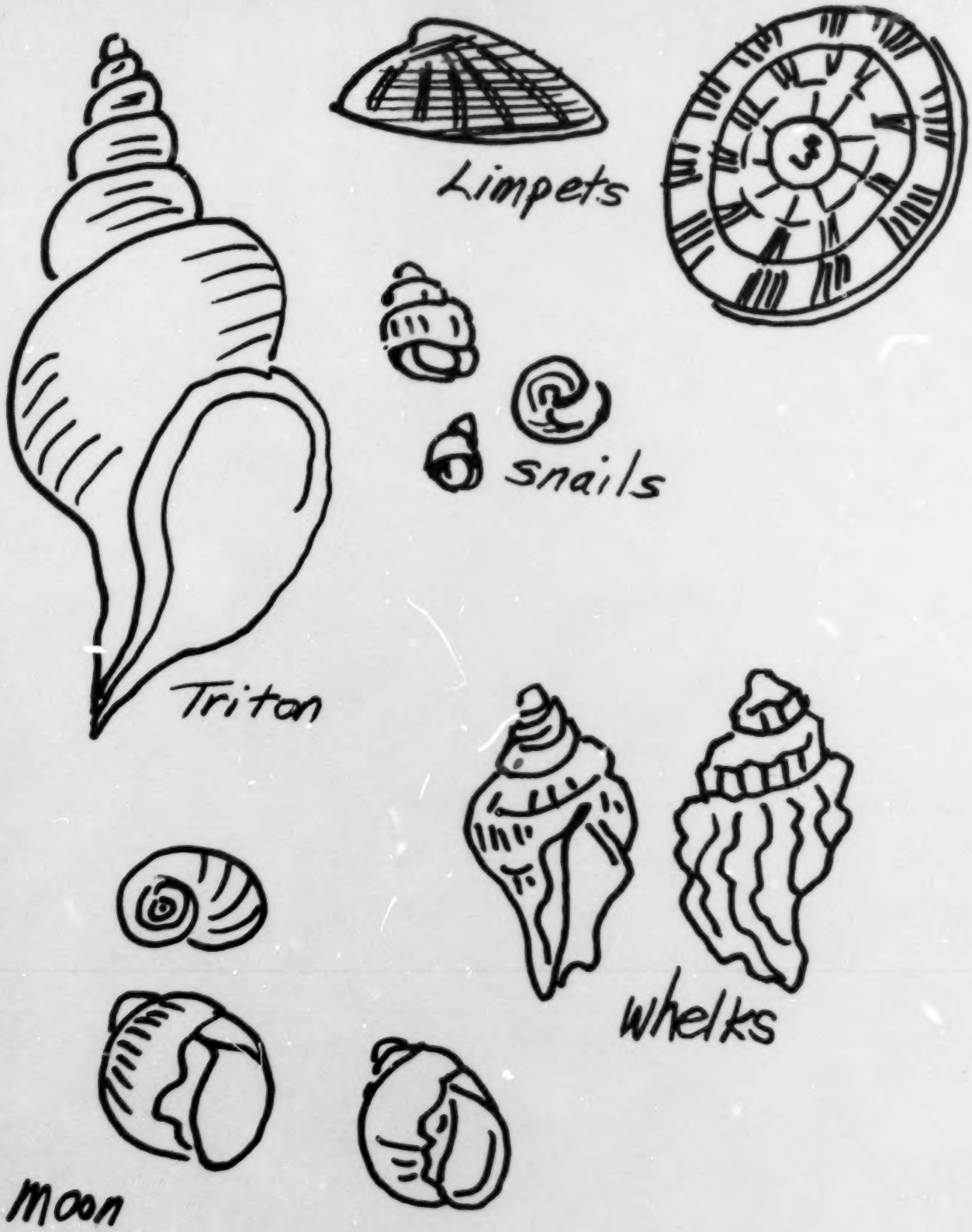
6. Overlap circles and rectangles as shown in the diagram above.

FOR FURTHER IDEAS ON BULLETIN BOARD DESIGN USE:

***Oversize LB 1584 .M414	Resource Book of Ideas for Student Designed Bulletin Boards. By Howard Melancon. T. S. Denison and Company, Inc. Minneapolis, Minnesota. 1973
LB 1043.5 .B4 L6	Better Bulletin Board Displays. Prepared by J. Preston Lockridge. Division of Extension. The University of Texas.
LB 1043.5 .K6	Baited Bulletin Boards. Handbook for teachers. Thomas Koskey. Fearon Publishers. 1954.
Oversize LB 1043.5 .c684	Guide to Better Bulletin Boards. By Coplan and Rosenthal. Ocieana Publications, Inc. 1970.

*** AVAILABLE THROUGH THE ALASKA STATE LIBRARY

DEPARTMENT OF EDUCATION
Pouch G
Juneau, Alaska 99811



Patterns - Univalves

STEPS TO ORGANIZING A SEA WEEK IN YOUR COMMUNITY

I. Familiarize yourself with the Sea Week curriculum and introduce it to other interested teachers and parents.

II. Catalog the resources in your area. Where are the good beaches? When are the good low tides? Are there any agency, hatchery, or museum personnel that would be available as speakers and/or for field trips?

III. Draw up a well-thought out plan for Sea Week and present it to your administrators for approval.

IV. Talk to teachers in the upper grades about having some of their students accompany you on your field trips. Brief them ahead of time as to the activities you'll be doing.

V. Make up a calendar of when speakers will talk, which movies will be shown, and when each class will take their field trips. By arranging two field trips near one another in location, or by having the second class come to the beach when the first field trip of the day is leaving, gas (and energy) can be saved by having fewer bus trips.

VI. Invite the whole community to participate - parents, chamber of commerce, governmental agencies, native corporations, fishermen, etc. Parents can assist with field trips; businesses might display student artwork. If community organizations are interested, the week can become a Festival of the Sea, with boat tours, movies, speakers, games, and dances. Contact your local paper about featuring Sea Week with a photo and story - beforehand, during, and afterwards! Radio stations might want to interview field trip leaders - or read stories that students have written.

VII. Spend an entire week studying the amazing ocean! Math problems, writing assignments, spelling words - can all relate to our marine environment. Show your students the wonder of sea life!

SUGGESTED FIELD TRIPS

In planning field trips for your class two things should be considered: 1. The emphasis in Sea Week studies at your grade level. 2. The available community resources.

Consider visiting a place - beaches, docks, vessels (fishing, pleasure, ferry, barge, tour ship, Coast Guard), cold storage plant, canneries, supermarket, government research facilities, hatcheries. Museums, private collections and stores might be considered for indoor trips. Arrangements might be made to watch someone at work - fisherman, biologist, or Coast Guard personnel. If your students have an opportunity to visit another community you might include Sea Week activities in your itinerary or might include the entire trip around them.

In planning any trip, if possible arrange for knowledgeable persons to accompany your group. The involvement of interested parents is also valuable.

SECOND GRADE

I. Beach - activities are suggested in guide.

II. Shell Collections

A. Museums - observation on formal exhibits of shells and their historic uses - money, jewelry, decoration.
B. Private Collections - Check for your community resources.
C. Activity - Work out a program for small groups with shells that can be handled, sorted, identified and parts of the shells identified.

WHAT TO DO ON THE BUS

Put together a checklist of objects (or use the one that follows) that the students may see at the beach. During the bus ride, students can circle the name (or picture) of each object that they think they will be seeing during the field trip. At the beach, they can check off the objects they actually saw, and estimate or count how many they saw. A Juneau teacher makes her checklists into a small book, with a pencil attached by yarn, and gives each pupil a sandwich bag in which to store his/her checklist.

bus	_____	cow	_____
can	_____	raven	_____
fish	_____	sheep	_____
tree	_____	driftwood	_____
gull	_____	boat	_____
buoy	_____	moose	_____
anemone	_____	dock	_____
whale	_____	starfish	_____
seaweed	_____	house	_____
crab	_____	airplane	_____
bottle	_____	fisherman	_____
jellyfish	_____	limpet shell	_____
sand flea	_____	sea urchin	_____
mussel	_____	porpoise	_____

CONSERVATION

Conservation may be defined as the "wise use" of our natural resources. It is not the non-use of them, but rather a use that comes after careful thought has been given to the reasons and consequences of that use.

It is perhaps trite to say that with increasing population pressures, the ever-increasing need for raw materials, for recreational facilities, for homesites, etc., pressures increase on a natural environment that may previously have been untrammeled and in no need of someone to protect it from total alteration. Here in Alaska, particularily, the residents of the State are faced with making many immediate far-reaching decisions about the natural environment of our State. What man's impact on it will be and if and how that impact should be limited or controlled are some of these decisions.

Conservation, practically, comes down to a few important principles:

1. Every living thing, as well as non-living thing, has a place and function in the balance of existence on the surface of this planet, whether or not we happen to know what its precise niche is. "Everything is connected with everything else." "Everything affects everything else." Destruction of one species, useless and unimportant though that species may seem to our ignorance, can have wide-reaching repercussions.

2. Natural resources are exhaustible. Populations which drop below a critical threshold cease to reproduce and the species plummets into extinction. Energy resources on earth are not renewable. Extinction of living species and exhaustion of non-living resources are natural processes. Trilobites went extinct before men appeared on the scene. Volcanoes spew noxious gases into the air. Nevertheless, the speed with which man, especially 20th century man, is destroying or using up extant life and resources is astronomical compared to natural processes.

3. Since man is an intelligent being, he can, if he will, desist from extinguishing life and exhausting the resources of the earth. Man can practice conservation without denying himself a full and enjoyable life. His reason for using resources wisely may be an idealistic appreciation of all that nature has and is, or it may be a realization that our tomorrows will be poorer unless wisdom regulates usage of our goods.[1]

For school children studying Alaska's marine life, conservation involves a few simple, yet extremely important principals:

1. DO VISIT THE BEACH AND ENJOY YOUR TIME THERE BUT WHEN YOU LEAVE, LET THE AREA BE THE SAME, OR BETTER, THAN YOU FOUND IT.

2. IF YOU TURN OVER A ROCK TO SEE WHAT IS HIDING UNDER IT, TURN IT BACK OVER WHEN YOU HAVE FINISHED. (What lives there may depend for survival on the exact kind of micro-habitat that exists under that rock.)

[1] Reef and Shore. Hawaii Nature Study Program for Elementary School Children, p. 4.

3. IF YOU PICK UP ANIMALS FOR CLOSER VIEWING, DISTURB ONLY THE ONES YOU WANT TO LOOK AT, HANDLE THEM CAREFULLY, THEN REPLACE THEM WHERE YOU FOUND THEM. SEA CREATURES CAN LIVE OUTSIDE OF THE WATER ONLY BRIEFLY. A PAN OR BUCKET OF SEAWATER WILL ALLOW CLOSER EXAMINATION AND REDUCE STRESS ON THE ANIMAL. KEEP THE CONTAINER OUT OF DIRECT SUNLIGHT AND REPLACE THE WATER IF IT BEGINS TO WARM. HANDLE FISH WITH WET HANDS TO PRESERVE THEIR PROTECTIVE SLIME AND IN HANDLING CRABS AND JELLYFISH - WATCH OUT FOR STINGERS AND PINCHERS. PICK CRABS UP FROM THE BACK AND SUPPORT THEIR UNDERSIDE WITH THE PALM OF YOUR HAND. DON'T TOUCH JELLYFISH.

4. IF YOU WANT TO USE LIVE MATERIALS IN THE CLASSROOM AFTER THE FIELD TRIP TO THE BEACH, TAKE ONLY WHAT YOU WILL NEED, TAKE CARE TO KEEP IT ALIVE, AND RETURN IT TO THE BEACH WHEN YOU ARE FINISHED WITH IT.

5. NON-LIVING BEACH MATERIALS MAY BE COLLECTED BUT USE MODERATION HERE, TOO. IF MATERIALS ARE FOR CLASS USE, HAVE A PROJECT IN MIND BEFORE YOU BEGIN COLLECTING AND THEN GATHER ONLY WHAT YOU WILL NEED. YOU MAY WANT TO GATHER DRIFTWOOD, STONES, BITS OF POLISHED GLASS. UNLESS YOU ARE A SECOND GRADE TEACHER, HOWEVER, PLEASE COLLECT ONLY A FEW, IF ANY, EMPLY SHELLS LEAVING THESE MATERIALS FOR THE SECOND GRADERS WHOSE ONLY SEA WEEK BEACH AND CLASSROOM ACTIVITY IS STUDYING THEM.

Appendix V

A CHECK LIST

FOR

A FIELD TRIP TO THE BEACH

You the teacher:

1. Be sure you are personally familiar with the beach to which you and your class are going. If you have not been there before, take a bit of time after school or on the weekend to go to that beach and walk it carefully. By being familiar with it yourself, you can anticipate what your students will be able to see and do there.

2. Check carefully on all bus arrangements for your class. Be sure that a bus is scheduled for you and be aware of the delivery and pick-up times.

3. Arrange for adequate adult supervision. Usually there is no problem in finding parents willing to go along. Often junior or senior high school students may also be available and, if they are taking biology or other related science courses, they can be very helpful. One older student or adult for every five or six children would be a good ratio in terms of safety, control, and learning.

4. Give careful thought to what you will do with your time at the beach. The beach is an exciting place just to explore, but some thought and directions given to the activities to take place will make the experience richer and more profitable for students and you, too.

5. Meet - or at least talk by phone - with your volunteers before the field trip to acquaint them with your plans for the outing. Be sure that each of them knows specifically what you would like each to do. Recommend that they attend appropriate training workshops and provide them with information from this guide or elsewhere.

6. Well in advance of the beach trip itself, begin preparing your students for their experiences there. The better prepared they are, the more successful the field trip will be.

7. Letters should be written to all parents, including permission slips, so that parents know about the activities in which their children will be involved.

8. Collect and ready all materials you will need for the field trip - buckets, pans, binoculars, camera, whatever it is you need. You might consider bringing or arranging for some kind of snack at the beach - a big bag of gorp (M & M's, raisins, salted peanuts, etc.) always makes a hit and a snack can serve

to reorganize matters at the beach and create a natural (though slightly contrived) change of pace and focus. (see the suggested time plan that follows.) Be sure to take along a supply of bandaids - or better yet, a small first-aid kit - just in case there is a need for it.

9. Plan the trip ahead, but allow for flexibility. If a whale is breaching just off shore while you are trying to teach the life and ways of a barnacle, your students will not be absorbing much of your lecture. Be prepared to take advantage of those special events that occur so often along our shores.

The students:

1. Involve them in preparing for the field trip as much as possible.

2. Explain to them any rules for field trip conduct. Stress especially the fact that the beach is a special environment and a fragile one whose beauty comes from the LIVING plants and animals to be found there. Impress upon them the need to respect the life forms they will see, to leave the beach as nearly like they find it as possible and not to collect or molest live beach animals unless you, the teacher, have very specific and well thought out needs for limited quantities of live animals and materials for use in further teaching processes and have requested the students help you gather materials.

3. A quick talk about safety at the beach would not be out of place - the need for proper clothing, care to be taken on rocks that are slippery when wet, what to do in case of injury, always keep an eye on the tide to be sure you are not stranded or lose gear to the rising waters, etc.

4. If a class project is planned for the beach time, help students to prepare or gather materials they will need to take with them.

BOTH teacher and students:

BE PROPERLY DRESSED. It is always difficult to predict what the weather will be in coastal Alaska but there is often a good chance that there may be rain. Be sure everyone knows that he or she should come dressed warmly and prepared for rain if that prospect seems at all likely. Wearing layers of clothes always makes sense - a short sleeved shirt, then something with long sleeves, topped by a sweater or warm jacket and something water and wind-proof. Foot gear is important. Layer socks for maximum warmth and wear RUBBER boots if possible. Carrying a back pack is a good idea for students and teachers alike. It leaves your hands free, lets you store away layers of clothes you want to shed or don't need at the moment and is a good place to keep the snack you and/or the students have decided to bring along.

SUGGESTED ON-SITE ORGANIZATION

The beach is an exciting place on your first visit there or your five hundredth and the most normal and natural thing to do on the beach is to walk - or run - along the shoreline to see what is there for the finding. If your class has been working hard on sea related studies and has carefully outlined what they want to do with their time at the beach, then perhaps all students will set right to work with whatever tasks have been outlined beforehand. But, if a less structured approach seems to be in order, you might try the following idea...

Part I

If, before the beach experience, you have been working in the classroom with the students on the particular area of marine knowledge outlined for your grade level, then the students should have a good idea of particular concepts or kinds of life or situations they might look for at the beach. Students could have the first half of the time at the beach to apply their knowledge in a free kind of framework. That is, for example, if you are a second grade teacher and have been studying shells with your students, give them the first part of their time at the beach to see how many different kinds of shells they can count, or give them some other similar kind of task that they can carry out and at the same time still be free to explore other aspects of the beach.

Part II

At the mid-point of your allotted time at the beach, gather the children together. Taking a bit of time out to open that big bag of gorp, or gathering for some other kind of snacking, works to draw everyone together, change the pace and focus.

After the quick energy break is a good time to have the students sit down quietly and talk about what they have seen or to have adult helpers work in small groups with children to share further discoveries or knowledge about materials found on the beach. As an example, if you are a first grade teacher who has been studying marine animals with your class, each adult helper might have been assigned to gather in a bucket - with the children's help - examples of a particular group of animals during the first part of the time on the beach. Then, during the second half of the beach time, each adult and his or her bucket of materials might circulate from one small group of children to the next, encouraging them to touch, feel, observe certain characteristics or qualities of these particular animals.

Children need both to enjoy the beach just for the pleasure there is in being there and to grow in understanding the complex web of life and environmental factors that are at work there. If careful thought and planning have gone on well before the actual trip to the beach, there is every reason to believe that both these goals can be accomplished.

A LOOK AT THE BEACH

Any beach is as individual in its own way as are we who, as individuals can be distinguished from all other people. Just as each of us represents only one combination out of the many possible, so it is with beaches. A beach is a place where the sea confronts the land, and every aspect of that sea and that land edge is important in determining what the general appearance of that beach will be and what kinds of plants and animals will grow and thrive in that particular environment. Many factors combine to determine the personality of that unique and special place.

The Sea

If we think first about the water at the beach, we realize that there are several ways in which it can vary. To begin with, for example, those of us living in the Juneau area look out to waters that are relatively protected. That is, our beaches are not subjected to the open, powerful swells that are common on coast lines that abut the open ocean. Unlike conditions that might be found at Sitka, for example, the wave conditions along our beaches are always relatively mild and non-violent. Even in the Juneau area, however, local differences in topography influence the personality of the beach. Whether a particular beach area is a straight, uninterrupted stretch, a deep or shallow cover, or a jutting point will influence the force and effect of the waves upon the shore. Consequently, we might expect to find different kinds of life on a point, in a cove, or on a straight, uncomplicated shoreline because each species has a particular ability to withstand greater or lesser wave force.

We all know that the sea is salty but we may not all realize that the concentration of salt in sea water can be highly variable. In the open ocean, salt concentrations measure about 32 to 33 parts per thousand. In our inside waters around Juneau, the average salt concentration in main channels may be slightly less than that because of the greater influence of fresh water entering from streams and rivers. At the mouths of the streams and rivers themselves, where salt and freshwater mix, salt concentrations are very low. Because each kind of marine plant or animal has its own built-in tolerances to varying saltiness or freshness, these living populations vary with the salinity prevalent at a particular place.

THE SIZE OF PEBBLES

If you stand on a beach and look thoughtfully at it, one of the first things you will notice is its texture - whether it it sandy, gravelly, composed of cobbles, bedrock, mud or a combination of two or more of these. The nature of the beach is critical in determining what can live there. Let's examine each kind of substrate in turn to see what kind of life we might expect to find.

Mud

Mud can be anything from relatively porous sand-soil mix to the clay muck that sucks rubber boots right off your feet. If you look at the surface of this kind of substrate, you will be aware of little, if any, life. Here and there you may see the flexible tubes of mud dwelling worms sticking up an inch or so above the surface. Or you may see "cake decorations" left by other burrowing worms. Finally, you may be aware of the presence of clams by the squirts of water and the siphon holes in the mud. Digging with a shovel will reveal the various inhabitants of the mud in all their glory - fat, bulbous peanut worms: slender, earthworm-like nemerteans of various descriptions; many-legged annelid worms; and hardy bivalves.

Sand

Because sand is more porous than mud, it is a better surface for many burrowers, a better surface for a wider number of animals to live on and in. On a sand flat at low tide one may find starfish, sea urchins, and numerous kinds of crabs and snails. Some of these animals wander over the sand flats when they are submerged, scouring them for bits of food. Some crabs, like the Dungeness, tend to stay in sandy areas because of the methods of self-protection involves burrowing into the sand to hide. (Even when the sand is exposed, watch for depressions in the surface that mimic the shape of the crab's shell. By digging there, you may uncover a crab that stayed buried even as the water receded.) By looking for clam or cockle siphon holes, you will discover these common residents of sandy areas and by digging carefully you may unearth them.

Cobbles and Boulders

Obviously, the size of loose rocks on the beach may range from something just a bit coarser than sand up to boulders too large to be lifted. In general, the larger the general size of the rock pieces, the greater variety of life one might expect to find there. The more stable the hard surface is, the greater protection and anchors it can afford a resident plant or animal. Intertidal areas of cobbles or rocks are often most obviously serving as anchorages for marine plants (most common in the Juneau area, Fucus, the rockweed, the tough, ubiquitous, brown plant with the bulbous reproductive bodies that kids like to pop) and for barnacles and blue mussels that may cover certain rocks of sections of beach in great density. If you begin to look down among the beds of rockweed, barnacles, and mussels and UNDER cobbles and boulders, you will discover an amazing diversity of life forms. Small six-rayed starfish cling beneath medium sized rocks, often brooding clutches of eggs. Blennies up to six inches or so in lenth (one of the two most common intertidally discovered fish) hide under rocks. So do amphipods or sand fleas and tiny crustacean beach scavengers that quickly seek new cover when discovered under their protective rock. Clinging to the surface of the rocks may be limpets, chitons, sponges. Look for the latter particularly under overhangs of larger rocks.

Because of their ability to serve as anchors and because they offer so many protective niches, rocks on beaches afford some to the best looking places. Don't neglect to have along a magnifying glass so you can really see some of the tiny critters! Guaranteed that the more your look, the more you will see there! Just be very sure that after you turn over a rock to reveal its underside residents, that you replace it so the animals don't dry out and perish!

Bedrock

This is just as exciting a place to poke as cobbles/boulder areas and many of the same inhabitants can be found here - with two general kinds of exceptions. First, obviously this rock surface can't be turned over so the "rock and sand or mud residents" are not here. Second, it is in bedrock areas that you are most apt to find remnant puddles of water - tidepools - that may harbor lots of life, including small anemones with tentacles extended to trap food (they come in a wide variety of gorgeous color combinations), rock hard coralline algae that looks like hard, pink plaster but are actually living plants, tiny immature sculpins, and perhaps little shrimp. Be sure to look carefully in crevasses for sponges, starfish, and other creatures.

THE DISTANCE FROM THE WATER

Each species of marine plant and animal has a particular tolerance to being out of salt water. Some of them, for example, are never found intertidally because they have absolutely no tolerance for exposure to the effects of an air environment. Others can stand being out of salt water for extended periods of time, needing only to be wet by the sea on occasional very high tides. By looking at the beach in a section from its highest high water mark down to the water level on a low, low tide, you can quickly begin to see major differences in plant and animal populations.

The Highest Fringe

At the upper limits of the intertidal zone, least life forms are evident. You may notice that the rocks appear black here. This is because they are covered by a black encrusting lichen or by a blue-green algae that makes these rocks treacherous and slippery when wet. In these upper reaches, too, may be found the common tiny periwinkle - a fat, ridged snail that sometimes seems to pepper the rocks.

The Middle Zone

As you move down toward the water's edge on a low tide, you will be aware of obvious color bands or patches on the beach. There may be banding of Fucus, the common brown rockweed, and of blue-black mussels (the intertidal - and subtidal - bivalve that attaches itself by tiny threads to rocks and pilings and other surfaces), and barnacles. Here too you will begin to see limpets (the species of which are sometimes most quickly identified by how low or high they are found on the beach) amphipods, various starfish, tiny black sea cucumbers, and other forms of life there were not in evidence at higher levels.

The Lowest Zone

As you approach the water's edge, you will not find some of the plants and animals that were evident at higher levels. In general, however, the lower you go in the intertidal zone the greater the diversity of life forms you will find. Here you will find sea urchins, a wide variety of often large starfish, perhaps juvenile king crabs, large white or varicolored sea anemones (if they are out ot water, these will look like squishy, uninviting blobs, but look out into the shallow waters to see the same animals in all their expanded glory), and the larger snails.

So...as you look at any particulat beach for the first time, there is a great deal to think about. Remember that each part of the beach, each kind of surface type, each height from the water, each kind of topographical variation indicates what life may be found there. In general, it is advisable to spend the lowest part of the tidal cycle closest to the water's edge for in that way you will have the maximum amount of time to spend along the beach area that is revealed to us least often and which tends to harbor the greatest diversity of plants and animals.

If you can, acquaint your students with these obvious or subtle variations in the beach habitat for it will enrich their beach experience, too!!!

TIDES

Students can understand some basics about tides and should definitely learn that the height of the water on the beach varies with the stage of the tide and that maximum and minimum tidal levels vary each day.

Tides, in a very simplified kind of explanation, occur because of the gravitational pull of the sun and the moon on the earth. Just as the earth exerts gravitational force (why does an apple fall? why can't we step off into space?), so do these other two bodies. The force of the pull of the sun and moon on a particular place on earth depends on how directly they are in line with that place. The force they exert tends to pull the water away from the earth's surface on the side of the earth facing,thus causing a high tide. Because the relative position of the sun, earth, and moon are constantly changing in a cyclic rhythm, so are the tides.

Activities

Here in Southeast Alaska we experience a tidal cycle that consists of two unequal high tides and two unequal low tides each day. With some students in primary grades and all those in upper grades, you might sit down with a tide table and look at the numbers and explain what they mean. You might even make a simple chart of tide levels and of activities to coincide with various stages of the tide. For instance, it might be much easier to launch a boat when the tide is high but digging clams can best be done on the very lowest tide. Students might be shown the same beach at high and at low tide and through words or art work compare the differences.

Preparation for Field Trip

In preparing for the field trip, discuss tides with the students. Mention the need to be as close to the water as possible when the tide is at its lowest in order to see that strip of beach and the life that is there, for the water quickly comes in and covers it. Talk, too, about the need to be aware of the tide level and thus not to set a pack or bucket next to the water's edge and expect to find it there later if the tide is flooding.

As a teacher you need to be aware of the time of low tide when scheduling your field trip to the beach and in planning the activities that will take place there. The time of very lowest tide should be kept open for observation of what is to be found in the zone nearest the water. Activities such as taking a break for a snack or gathering around buckets to discuss and examine particular animals should occur when the tide is ebbing or flooding.

A BIBLIOGRAPHY OF HELPFUL REFERENCES

Field Guides

Abbott, R. T. 1968. *Seashells of North America.* Golden Press, New York. 280 pp. $3.95.

Ayres, J. and D. McLachlan. 1979. *Fieldbook of Pacific Northwest Sea Creatures.* Naturegraph Publishers, Inc. Happy Camp, California. 208 pp. $10.00.

Furlong, M. and V. Pill. 1973. *Edible? Incredible!* ERCO, Inc., Tacoma, Washington. 62 pp. $2.50.

_____. 1973. *Starfish - Guides to Identification and Methods of Preserving.* ERCO, Inc., Tacoma, Washington. 104 pp. $3.50.

Guberlet, M. L. 1956. *Seaweeds at Ebb Tide.* University of Washington Press, Seattle. 182 pp. $4.95.

Hosie, R. C. 1969. *Native Trees of Canada.* Information Canada, Ottowa. 380 pp. $7.20.

Kozloff, E. N. 1974. *Keys to the Marine Invertebrates of Puget Sound, the San Juan Archipelago and Adjacent Regions.* University of Washington Press, Seattle. 266 pp.

Madlener, J. C. 1977. *The Seavegetable Book.* Clarkson N. Potter, Inc., New York. 288 pp. $6.95 (recipes!).

McClane, A. J. 1978. *Field Guide to Saltwater Fishes of North America.* Holt, Rinehart and Winston, New York. 283 pp.

Murie, Olaus J. 1975. *A Field Guide to Animal Tracks.* Moughton Miffin Co., Boston. 375 pp. $6.95.

Murray, C. and D. Somerton. 1976. *Field Guide to the Fish of Puget Sound and the Northwest Coast* (printed on waterproof paper). University of Washington Press, Seattle. 70 pp. $5.95.

Rice, T. 1973. *Marine Shells of the Pacific Coast.* ERCO, Inc., Tacoma, Washington. 102 pp. $2.95.

Robbins, C. S., B. Bruun, and M. S. Zim. 1966. *Birds of North America.* Golden Press, New York. 340 pp. $4.95.

Smith, L. S. 1976. *Living Shores of the Pacific Northwest.* Pacific Search Press, Seattle. 149 pp. $9.95.

Viereck, L. A. 1974. *Guide to Alaska Trees.* United States Forest Service, Washington, D. C. 98 pp. $1.35.

Waaland, J. R. 1977. *Common Seaweeds of the Pacific Coast.* Pacific Search Press, Seattle, Washington. 120 pp. $5.95.

Marine Mammals

Graves, J. A. 1977. *What is a California Sea Otter?* Boxwood Press, Pacific Grove, California. 30 pp. $3.50.

McDearmon. 1974. *The Walrus - Giant of the Arctic Ice.* Dodd, Mead, and Co., New York. 45 pp. $4.25.

Proctor, S. J. 1975. *Whales - Their Story.* Vancouver Public Aquarium Association Newsletter vol. XIX no. 4, July/ August 1975. Vancouver, British Columbia, Canada. 14 pp.

Slijper, E. J. 1976. *Whales & Dolphins.* The University of Michigan Press. 170 pp.

Stonehouse, B. 1976. *A Closer Look at Whales and Dolphins.* Gloucester Press, New York. 31 pp. $1.95.

Fish

Burton, Dr. M. 1972. *The Life of Fishes.* Golden Press, New York. 61 pp. $2.95.

Childerhose, R. J. and M. Trim. 1979. *Pacific Salmon.* University of Washington Press, Seattle. 158 pp. $24.95.

DeCarli, F. 1978. *The World of Fish.* Abbeville Press, New York. 256 pp. $6.95.

Hart, J. L. 1973. *Pacific Fishes of Canada.* Fisheries Research Board of Canada, Ottowa. 740 pp. $14.40.

Birds

Bradbury, W. 1976. *Birds of Sea, Shore, and Stream.* Time Life Films, Inc. 128 pp. $8.95.

Ecology

Adams, R. 1978. *Nature Day and Night.* Viking Press. New York. 107 pp. $10.00.

British Museum of Natural History. 1978. *Nature at Work.* British Museum, London. 84 pp. $4.95.

Carefoot, T. 1977. *Pacific Seashores.* University of Washington Press, Seattle. 208 pp. $14.80.

Activities

Cornell, J. B. 1979. *Sharing Nature With Children.* Ananda Publications. 142 pp. $4.95.

Curriculum Research and Development Group - University of Hawaii. 1976. *Reef and Shore - Hawaii Nature Study Program for Elementary School Children, Teachers' Guide.* University of Hawaii, Honolulu. 265 pp.

Lien, V. 1979. *Investigating the Marine Environment and Its Resources.* Sea Grant College Publications, Texas A and M University, College Station, Texas 17843. 439 pp. $8.00

Mauldin, L. and D. Frankenberg. 1978. *North Carolina Marine Education Manual* (4 volumes). UNC Sea Grant Publication UNC-56-78-14-A, North Carolina State Univesity, Raleigh, North Carolina 27607.

Oceanography

Bascom, W. 1964. *Waves and Beaches: the Dynamics of the Ocean Surface.* Doubleday and Company, Inc., Garden City, New York. 267 pp. $2.50.

Scientific American. 1969. *The Ocean.* W. H. Freeman and Company. 140 pp. $3.25.

Issues

Ball, J. L. Jr., T. Frady, and R. S. Lee (eds). 1977. *Readings From Alaska Seas and Coasts.* Alaska Sea Grant Program, Fairbanks. 252 pp.

Browning, R. J. 1974. *Fisheries of the North Pacific: History, Species, Gear, and Processes.* Alaska Northwest Publishing Company. Anchorage. 408 pp. $24.95.

Drucker, P. 1963. *Cultures of the North Pacific Coast.* Chandler Publishing Company, Scranton, Pennsylvania 243 pp.

Figdor, B. and G. 1978. *Salmon Fishing* (one of a children's series of people at work in Alaska). George Figdor, Haines, Alaska. 48 pp. $7.95.

Kramer, L. S., V. C. Clark, and G. J. Cannelos. 1978. *Planning for Offshore Oil Development: Gulf of Alaska OCS Handbook.* Alaska Department of Community and Regional Affairs, Division of Community Planning, Juneau. 257 pp.

Miscellaneous and General References

Alaska Dept. of Fish and Game. *Wildlife Notebook Series. (fish species and crabs)* Juneau.

Angel, H. 1976. *Life in the Oceans.* Cathay Books, London. 125 pp. $6.66.

Angel, T. and Harris. 1977. *Animals of the Oceans.* Two Continents Publishing Group, New York. 156 pp. $10.95.

Berrill, N. J. 1966. *The Life of the Ocean.* McGraw-Hill Book Company, New York. 232 pp. $7.50.

Calvin, J. and E. Ricketts. 1968. *Between Pacific Tides.* Fourth Edition. Stanford University Press, California. 614 pp. $12.50

Flora, C. J. and E. Fairbanks, M.D. 1977. *The Sound and the Sea: A Guide to Northwestern Neritic Invertebrate Zoology.* Washington State Dept. of Printing, Olympia. 474 pp. $8.50.

Johnson, M. E. and H. J. Snook. 1927. *Seashore Animals of the Pacific Coast.* McGraw-Hill, New York. 523 pp.

Tyler, J. 1976. *The Children's Book of the Seas.* Usborne Pub. Ltd., London. 32 pp. $2.95.

United States Forest Service. *Beach Camping* and other informative publications. Juneau.

University of Alaska. Alaska Sea Grant Program. *Alaska Tidelines,* a Sea Grant Publication for Alaska Schools. Fairbanks.

Plus +++ check with agencies in your area, aquaculture associations, the U. S. Coast Guard, local corporations to see what publications they may have available.

OTHER LEARNING AIDS

The Alaska State Museum has multi-media learning kits available for use by Alaskan schools, including a Salmon kit. Priority use is given to bush schools. Write: Alaska State Museum, Pouch FM, Juneau, Alaska 99811.

Your school can order films through the Alaska State Film Library. Their marine science/oceanography listings are too numerous to mention, but some topics that are dealt with include: marine invertebrates, ocean currents, the beach, whales, life cycle of the salmon, mollusks, tide pool life, marine science careers, sea birds, octopus, the ocean as a food source, fishing techniques, the ecology of the ocean, and seacoast cultures.

The Smithsonian Institution is currently field testing a binder of estuary study activities ($9.68). Activities include: Beachcombing, Mapping, Barnacles, Build A Trap, Fish Adaptations, Fish, Marsh Muck, Crabs, Water in Motion, Menance Oil Slick, Oil Spill Cleanup, and Estuary 3-D Board. For more information write:

SEA (Smithsonian Estuarine Activities)
Chesapeake Bay Center For Environmental Studies
Smithsonian Institution
P. O. Box 28
Edgewater, Maryland 21037

Posters on beach safety and pamphlets on tides, whales, crabs, and other marine topics are available from the Oregon State University Sea Grant Marine Advisory Program. For a catalog and price list (many are free) write:

Extension Communication-Marine Advisory Program
Oregon State University AdS 422
Corvallis, OR 97331

ALASKA SEA WEEK EVALUATION FORM

computer code numbers

1. Town or village _____ (1-4)
2. Grade level _____ (5)
3. Number of students involved _____ (6-7)

(8-10)

You may need to review your Alaska Sea Week materials to answer these questions.

4. How many classroom (indoor) activities and worksheets did you use from each book?

Book (Grade level)	Number of activities	
Discovery (K)	_____	(11-12)
Sea Animals (1)	_____	(13-14)
Shells (2)	_____	(15-16)
Glacial & Intertidal Ecology (3)	_____	(17-18)
Birds (4)	_____	(19-20)
Fish (5)	_____	(21-22)
Man's Influence on the Sea (6)	_____	(23-24)

5. What is the total number of field (outdoor) activities used from the 7 books? _____ (25-26)
6. How many periods (1 hr. each) did your class spend on the Sea Week Program? _____ (27-29)

Please check the appropriate box to the right of each question.

	decidedly yes	yes	no opinion	no	decidedly no	
7. Were the Alaska Sea Week materials relevant to your curriculum?	(1)	(2)	(3)	(4)	(5)	(30)
8. Did the Sea Week materials motivate students to improve their math, reading, & writing skills?	(1)	(2)	(3)	(4)	(5)	(31)
9. Did the Sea Week materials upgrade your science program?	(1)	(2)	(3)	(4)	(5)	(32)
10. Did students enjoy the Sea Week activities?	(1)	(2)	(3)	(4)	(5)	(33)
11. Did students develop a greater awareness, appreciation, and respect for the sea?	(1)	(2)	(3)	(4)	(5)	(34)
12. Did students develop decision-making skills necessary for resolution of marine issues?	(1)	(2)	(3)	(4)	(5)	(35)
13. Was the material appropriate for your students' grade level?	(1)	(2)	(3)	(4)	(5)	(36)
14. Was the teacher background section adequate?	(1)	(2)	(3)	(4)	(5)	(37)
15. Were the teacher instructions helpful & complete?	(1)	(2)	(3)	(4)	(5)	(38)
16. Were parents and other community members involved in your Sea Week?	(1)	(2)	(3)	(4)	(5)	(39)
17. Were parents favorably impressed with the Sea Week Program?	(1)	(2)	(3)	(4)	(5)	(40)
18. Did Sea Week help improve the relationship of the school to the community?	(1)	(2)	(3)	(4)	(5)	(41)

19. Rate your overall feelings about the Sea Week MATERIALS on a scale of 1 to 5. _____ (42)
(1=high; 5=low)
20. Rate your overall feelings about the Sea Week PROGRAM on a scale of 1 to 5. _____ (43)
(1=high; 5=low)

(OVER, PLEASE)

21. How many teachers are in your school? _____
How many are using Sea Week materials? _____ (44-45)

22. Do you plan to introduce the Sea Week materials to other teachers? yes____(1)
no____(2) (46)

23. Do you plan to use the Sea Week materials again? yes____(1) no____(2) (47)

24. Would you be interested in attending a marine ucation/Sea Week workshop?
yes____(1) no____(2) (48)

If so, list your name and school address:

Name _____

Address _____

25. What other comments do you have? Are there any specific improvements you would suggest?

Please return this completed form to Jill Thayer/Belle Mickelson, Alaska Sea Grant Program, University of Alaska, Fairbanks, Alaska 99701.